Counterpart - Bethany Walker

RECORDATION NO 20584 FILED 1425

JAN 29 1997 PM

HOPKINS & SUTTER

(A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS)

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CHICAGO OFFICE THREE FIRST NATIONAL PLAZA 60602
DALLAS OFFICE 3700 BANK ONE CENTER 1717 MAIN STREET 75201

CHARLES A. SPITULNIK
(202) 835-8196

RECEIVED SURFACE TRANSPORTATION BOARD JAN 29 4 19 PM '97

January 29, 1997

BY HAND DELIVERY

Mr. Vernon A. Williams
Secretary
Surface Transportation Board
Room 1324
12th Street & Constitution Avenue, N.W.
Washington, D.C. 20423

Re: Agreement Between Philip Morris, Inc. and Rader Railcar, Inc.

Dear Mr. Williams:

Enclosed please find two copies of the documents described below, to be recorded pursuant to Section 11301 of Title 49 of the U.S. Code. I am providing under separate cover an affidavit certifying their authenticity.

The following document creates a bailment relationship between Philip Morris, Inc. ("PM") as bailor and Rader Railcar, Inc. ("Rader") as bailee, and requires recordation:

> An agreement between PM and Rader dated October 1, 1994 (the "Agreement"). This is the primary document.

The names and addresses of the parties to the document are as follows:

Bailor: Philip Morris, Inc.
120 Park Avenue
New York, N.Y. 10017

Bailee: ✓Rader Railcar, Inc.
10700 E. 40th Avenue
Denver, CO 80239

Q50024-1

A description of the 18 rail cars covered by the document follows:

Seven (7) Sleeper Cars (Code Numbers THSC 1-3, 5-8): Three (3) bi-level rail cars with 13 Standard State rooms, one (1) Deluxe Cabin and one (1) Superior Cabin; all cabins having independent bathroom with showers, vanity sink and toilets and double sleeping accommodations. Communications to all other cabins and public phones. Audio visual entertainment center and individual climate and lighting controls. Security safes and luggage storage. Upper level cabins have overhead dome windows.

One (1) Sleeper Car (Code Number THSC4): Bi-level rail car with 13 Standard State rooms, one (1) Deluxe Cabin and one (1) Superior Cabin; all cabins having independent bathroom with showers, vanity sink and toilets and double sleeping accommodations. Communications to all other cabins and public phones. Audio visual entertainment center and individual climate and lighting controls. Security safes and luggage storage. Upper level cabins have overhead dome windows. This car also has one cabin that can accommodate a disabled person and one cabin that will serve as an infirmary.

One (1) Spa Car (Code Number THSPA): Single level domed glass rail car with panoramic view and open-end platform equipped with five (5) spa hot tubs each accommodating up to seven (7) people, two (2) massage rooms and shower and changing facilities.

One (1) Diner with Galley (Code Number THDWG): Bi-level rail dining car with full service galley on lower level. Upper level dining area capable of seating approximately 60 guests. Upper level also includes two (2) hydraulic dumb waiters from the lower level main galley, and a small food service area for final meal preparation.

One (1) Diner no Galley (Code Number THDNG): Bi-level rail car with upper level dining area able to accommodate approximately 52 guests with access to upper level of adjoining public cars, one of which is DWG to accommodate meal service. Lower level entertainment area and cinema able to seat 10 as well as a reading room and open sitting area. This car also has an ADA accessible toilet.

One (1) Lounge Car (Code Number THLC1): Bi-level rail car with office facilities on lower level, including full time security. This car has an open platform at the end of the car. Upper level lounge seating with small bar.

This car will eventually have an ADA lift for disabled passenger access from station platforms. This car has a unisex public toilet on lower level. Upper level has lounge seating and a small bar.

One (1) Lounge Car (Code Number THLC2): Bi-level rail car with lower level arrangement for lounging. This car has a public unisex toilet as well as a separate ADA accessible toilet on one end of car. Upper level has two lounging areas plus a small bar and an open floor area to view the lounge area below.

One (1) Lounge Car (Code Number THLC3): Bi-level rail car where the lower level arrangement has a bar and dance floor with adjoining lounge area immediately below an opening to the upper level. This car also has a public unisex toilet as well as a separate ADA accessible toilet on one of the cars. The upper level has a bar and lounging area on either side of opening to the lower level.

One (1) Staff Sleeping Car (Code Number THST1): Single level rail car with sleeping accommodations for 33 people.

One (1) Staff Car (Code Number ST2): Single level rail car with dining area, full galley and lavatory facilities.

One (1) Staff Car (Code Number THST3): Single level rail car with sleeping accommodations for 28; also houses all hardware for IS communications.

One (1) Power Car (Code Number PWR): Single level rail car equipped with three (3) diesel caterpillar units each capable of producing 725 kilowatts and 950 horsepower.

A short summary of the document to appear in the index follows:

The Agreement between Philip Morris Inc. ("PM") and Rader Railcar, Inc. ("Rader") dated October 1, 1994 creates a bailment relationship between PM as bailor and Rader as bailee. Pursuant to this document, Rader was entrusted with possession of the equipment owned by PM, consisting of 18 railcars, solely to provide the service of outfitting such railcars to conform to specifications set forth in the agreement. Once the service was complete, Rader would return the cars to PM's possession and terminate the bailment.

A fee of $22.00 is enclosed. I have enclosed three (3) additional copies to be stamped and returned to me via our messenger. Thank you for your attention to this matter.

Respectfully submitted,

Charles A. Spitulnik

Charles. A. Spitulnik

Enclosures

SURFACE TRANSPORTATION BOARD
WASHINGTON, D.C. 20423-0001

1/29/97

Charles A. Spitulnik
Bopkins & Sutter
888 Sixteenth Street, NW
Washington, DC., 20006

Dear Sir:

The enclosed document(s) was recorded pursuant to the provisions of Section 11303 of the Interstate Commerce Act, 49 U.S.C. 11303, on 1/29/97 at 4:20PM, and assigned recordation number(s). 20524, 20524-A and 20524-B.

Sincerely yours,

Vernon A. Williams

Vernon A. Williams
Secretary

Enclosure(s)

$ 66.00 The amount indicated at the left has been received in payment of a fee in connection with a document filed on the date shown. This receipt is issued for the amount paid and in no way indicates acknowledgment that the fee paid is correct. This is accepted subject to review of the document which has been assigned the transaction number corresponding to the one typed on this receipt. In the event of an error or any questions concerning this fee, you will receive a notification after the Commission has had an opportunity to examine your document.

Signature Janice M. Fort

HOPKINS & SUTTER
(A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS)

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RECORDATION NO 20524 FILED 1425
JAN 29 1997 -4 20 PM

CHARLES A. SPITULNIK
(202) 835-8196

January 29, 1997

Mr. Vernon A. Williams
Secretary
Surface Transportation Board
Room 1324
12th Street & Constitution Avenue, N.W.
Washington, D.C. 20423

Re: Agreement Between Philip Morris, Inc. and Rader Railcar, Inc.

Dear Mr. Williams:

I am enclosing an Acknowledgement and Certification of Dennis Floam, Assistant Secretary of Philip Morris, Inc. certifying that the following documents, filed today with the Surface Transportation Board, are complete and identical copies of the originals of each of those agreements, respectively:

1. An agreement between Philip Morris and Rader Railcar, Inc. dated October 1, 1994. This is the primary document.

2. Amendment No. 5, dated June 13, 1996, to the Agreement between Philip Morris, Inc. and Rader Railcar, Inc. dated October 1, 1964. This is a secondary document; and

3. Amendment No. 9, dated July 26, 1996, to the Agreement between Philip Morris, Inc. and Rader Railcar, Inc. dated October 1, 1964.

I am also enclosing an additional copy of this Certification, along with three additional copies that I would appreciate your date-stamping and returning to me via our messenger. Thank you for your assistance.

Sincerely,

Charles A. Spitulnik

Enclosures

ACKNOWLEDGEMENT AND CERTIFICATION

State of New York)
) SS:
County of New York)

I, Dennis Floam, certify on this 27th day of January, 1997, that I am Assistant Secretary of Philip Morris Incorporated (the "Corporation"), that the copies filed herewith have been compared with the original agreement and amendments thereto and are, in all respects, complete and identical copies thereof, that the agreement and amendments thereto were signed on behalf of the Corporation by authority of its Board of Directors, and that I acknowledge that the execution of the foregoing agreement and amendments thereto was the free act and deed of the Corporation. I further declare under penalty of perjury that the foregoing is true and correct.

Subscribed and sworn to before me this 27th
day of January 1997.

Notary Public

My Commission Expires:

JOSE LUIS MURILLO
State of New York
New York County

AGREEMENT

BETWEEN

PHILIP MORRIS INCORPORATED

AND

RADER RAILCAR, INC.

Effective October 1, 1994

AGREEMENT
BETWEEN
PHILIP MORRIS INCORPORATED AND RADER RAILCAR, INC.

TABLE OF CONTENTS

AGREEMENT

This Agreement, effective October 1, 1994, is by and between Philip Morris Incorporated, doing business as Philip Morris U.S.A., a Virginia corporation with offices at 120 Park Avenue, New York, New York 10017 ("Philip Morris") and Rader Railcar Inc., a Colorado corporation with offices at 10700 East 40th Avenue, Denver, Colorado 80239 ("Contractor").

1. Philip Morris desires to acquire specially outfitted railcars, locomotives and a power/utility car and other associated services, if any, for use in Philip Morris' product promotions.

2. Contractor is willing to furnish the specially outfitted railcars and a power/utility car, to modify locomotives provided by Philip Morris and to provide associated services, if any, to Philip Morris as more particularly described herein.

Therefore, in consideration of the promises contained herein, the parties agree as follows:

1. __Defined Terms__. In addition to other defined terms contained in this Agreement, the following definitions shall apply:

1.1 Agreement: this agreement consisting of 39 pages, and any amendments hereto.

1.2 ADA: the Americans with Disabilities Act, as amended.

1.3 Applicable Standards: all applicable federal, state, local and industry standards, specifications and regulations, including but not limited to those of the American Association of Railroads, Federal Railroad Administration, American Welding Society, National Electrical Code and AMTRAK applicable to the Trainset or any of its components on the execution date hereof.

1.4 Application for Payment: the form of request for payment by Contractor as provided in Section 11.2 and set out in Schedule J.

1.5 Cash Flow Projection: the cash flow projection set out in Schedule C hereto.

1.6 Contract Documents: the documents identified in Section 2.

1.7 Contract Price: the compensation payable by Philip Morris to Contractor pursuant to Section 11.

1.8 Contractor Default: the events of default set out in Section 26.1.

1.9 Default Milestones: the default milestone dates specified in the Production Schedule.

1.10 Dispute: any dispute, controversy or claim arising out of or relating to this Agreement (excluding disputes that are submitted to the Technical Arbiter pursuant to Sections 12.4.2 and 13 or to the Manufacturing Expert pursuant to Section 9.1) or any breach, termination or invalidity hereof.

1.11 Engineer: Philip Morris' consulting engineer and such other representative as Philip Morris may designate in writing.

1.12 Final Acceptance: this term shall have the meaning set out in Section 7.

1.13 Final Delivery Date: the date for Final Acceptance of the Trainset in accordance with Section 7 hereof, which date shall be specified in the Production Schedule.

1.14 Force Majeure: this term shall have the meaning set out in Section 23.

1.15 Interim Period: the period between Provisional Acceptance of Railcars and commencement of operational trials by Contractor pursuant to Section 7.

1.16 Letter Agreement: the letter agreement dated October 19, 1994, as amended by the parties October 31, 1994, November 7, 1994 and November 30, 1994. The letter agreement is attached hereto as Exhibit 1 and is superseded by this Agreement.

1.17 Locomotives: base locomotives provided by Philip Morris for modification by Contractor in accordance with this Agreement, the Specifications and Contract Drawings.

1.18 Manufacturing Expert: an individual experienced in the manufacture of trains mutually agreed upon by the parties prior to the date of execution of this Agreement, designated in Schedule I.

1.19 Modified Locomotive: a Locomotive modified in accordance with the requirements of this Agreement, the Specifications, and Contract Drawings.

1.20 Contract Drawings: The drawings listed in Section 2 of the Specifications and provided with this Agreement which are graphic representations of the Specifications and prepared by Contractor.

1.21 Point of Contact: the individual designated by Philip Morris in writing to act as its point of contact pursuant to Section 4.

1.22 Provisional Acceptance: provisional acceptance by Philip Morris of the Railcars pursuant to Section 5.

1.23 Railcar: any individual railcar, including dome sleeper cars, dome diner cars, dome lounge cars, a dome spa car, crew cars and the power/utility car, specially outfitted in accordance with the requirements of this Agreement, the Specifications and Contract Drawings.

1.24 Samples: materials and other items sufficient to determine whether the kind, quality, construction, workmanship, finish, color and other characteristics of materials and other items proposed by Contractor conform to the required characteristics of the Work. Samples include natural materials, fabricated items, devices, appliances, parts of such items, and any other materials and other items reasonably requested by Engineer.

1.25 Production Schedule: the schedule set out in Schedule E, as modified by the parties pursuant to this Agreement.

1.26 Shop Drawings: the working drawings (other than the Contract Drawings) prepared or furnished by Contractor pursuant to this Agreement, the Specifications and Contract Drawings. Shop Drawings include, but are not limited to, fabrication, layout and assembly drawings, manufacturers' standard drawings, schedules, descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; and all other drawings and descriptive data pertaining to the materials, equipment and electrical systems and methods of completion of the Work, all as may be required to show that the materials, equipment and systems, and their location, conform to the Contract Documents. Shop Drawings shall establish the actual detail of all manufactured (i.e., standard units, usually mass produced) or fabricated (i.e., specially assembled or made out of selected materials to meet individual design requirements) items; shall indicate proper relation to adjoining work; shall amplify design details of mechanical and electrical equipment in proper relation to physical spaces in the applicable part of the Trainset; and shall incorporate minor changes of design or construction, as compared with the Drawings, Plans and Specifications, necessary to suit actual conditions as provided hereafter.

1.27 Specifications: the description of the technical responsibilities of Contractor and the specific technical and design requirements necessary to produce a Trainset suitable for use in Philip Morris' planned Marlboro Unlimited promotion prepared by Contractor and approved pursuant to Section 12.

1.28 Technical Arbiter: the individual mutually agreed upon by the parties prior to the date of execution of this Agreement and designated in Schedule I.

1.29 Trainset: the complete set of Railcars and Modified Locomotive(s) to be delivered in accordance with this Agreement, the Specifications and Contract Drawings.

1.30 Work: all design services, fabrication, supervision, assembly, labor, materials, systems, supplies, tools, equipment, material and machinery described in Section 3 provided by Contractor and required to supply the Trainset in accordance with the requirements set forth in this Agreement, the Specifications and Contract Drawings, including negotiation of track rights pursuant to Section 3.4.

2. Contract Documents

2.1 Contract Documents. The Contract Documents consist of this executed Agreement and the following schedules (the "Schedules") attached hereto and incorporated by reference into this Agreement, all of which are collectively referred to herein as the "Contract Documents":

SCHEDULE A - Specifications
SCHEDULE B - Contract Drawings
SCHEDULE C - Cash Flow Projection
SCHEDULE D - Track Right Negotiation Authorization
SCHEDULE E - Production Schedule
SCHEDULE F - Base Railcars
SCHEDULE G - Ultradome Ride Quality Report
SCHEDULE H - Ultradome Finite Element Analysis
SCHEDULE I - Manufacturing Expert and Technical Arbiter
SCHEDULE J - Form of Application for Payment
SCHEDULE K - Change Order Form
SCHEDULE L - Form of Payment Affidavit
SCHEDULE M - Form of Subcontractor's Confidentiality and Patent Agreement

2.2 Order of Precedence of Contract Documents. In the event of any conflict or inconsistency between this Agreement and any of the Schedules, the terms of this executed Agreement shall control. In the event of any conflict or inconsistency between Schedule A (Specifications) and Schedule B (Contract Drawings), Schedule A shall control. In the event of any conflict or inconsistency between or among any other Schedules, Contractor shall obtain clarification from Philip Morris. The Contract Documents are complementary and intended to be read together to include or imply all instructions and items required for the proper execution and completion of the Work.

3. The Work

3.1 The Trainset.

3.1.1 Contractor shall supply and outfit the Railcars in accordance with the requirements set forth in this Agreement, the Specifications and Contract Drawings. The Work includes all design services, engineering services, fabrication, assembly, testing, supervision, labor, materials, supplies, tools, equipment and machinery required to outfit and supply Railcars that conform in all respects to this Agreement, the Specifications and Contract Drawings. The Work also includes all design services, engineering services, fabrication, supervision, labor, materials, supplies, tools, equipment and machinery required to modify two Locomotives in accordance with the requirements set out in this Agreement, the Specifications and Contract Drawings. The Work described in this Section 3.1 may be modified from time to time in accordance with the requirements of this Agreement.

3.1.2 At Philip Morris' option, such option to be exercised on or before December 15, 1994 by providing written notice to Contractor, Philip Morris may modify the Work by eliminating the Modified Locomotives from the Trainset. At Philip Morris' option, such option to be exercised at any time by providing written notice to Contractor, Philip Morris may modify the Work by increasing the number of Modified Locomotives to be supplied as part of the Trainset.

3.1.3 The general description of the Trainset is set out below. Detailed descriptions are set out in the Schedules hereto, which more detailed Schedules shall govern:

3.1.3.1 Eight full dome sleeper cars will be bi-level with dome glass windows the full length of the car. Each full dome sleeper car will have 15 double-occupancy cabins, allowing for 240 passengers per Trainset. Each cabin will have private toilets with separate showers, drawer and closet space adequate for a five-day stay, adequate electrical outlets commensurate with luxury travel and hookups for TV/VCR, as well as the TV/VCRs.

3.1.3.2 Two full dome diner cars will be bi-level cars and consist of dining room seating on the upper level and one car with a galley the full length of the lower level and the other car with a library, sundry store and service area on the lower level. The galley will be able to prepare fresh foods for three meals per day. Storage will be adequate for staples and the majority of perishables. Dining rooms and galley will be capable of serving all passengers in two seatings.

3.1.3.3 Three full dome lounge cars will be bi-level cars and consist of lounge seating on the upper level with three different lower levels consisting of (1) a Philip Morris office on one car, (2) multi-media center, including a big-screen TV, with an open-air platform, and (3) a large bar on the third car. The office area will be sufficient for six to eight people, with hook-up for faxes, phones, computers and other office equipment. These cars will have a combined capacity of at least 300 passengers when fully occupied with both seated and standing passengers. There will be dance floors installed in the bar areas.

3.1.3.4 One full dome spa car will be a single level car with an open-air observation platform. The car will have hot-tubs with total capacity for 18-30 people. The car will have two to four private massage rooms and separate male/female changing rooms with showers.

3.1.3.5 One power/utility car will feature a self-contained power supply with adequate backup to allow the Trainset to operate at a minimum of 85% of installed electrical load when one generator is out of service.

3.1.3.6 Three crew cars will be single level sleepers with two cars having 22 roomettes and the other having eight roomettes and a dining/lounge area for the staff. Each staff roomette will be single-occupancy and have private closet/drawer space with locks and under seat storage for bags. Staff sleeper cars will have separate male and female multiple-cabin use toilet facilities.

3.1.3.7 Modifications will be made to two Locomotives unless Philip Morris gives written notice to Contractor pursuant to Section 3.1.2 that the number of Locomotives to be modified is increased or eliminated from the Work. These modifications will consist of a fiberglass shell to be attached to the Locomotives to give the Locomotives a more streamlined appearance.

3.1.3.8 Two sleeper cabin mockups will be built, one for the upper level dome cabin and one for the lower level cabin. The mockups will consist of a full-size section of a sleeper car to show a complete upper and lower level passenger cabin set with representative beds, mattresses, tables, cabinets and with wall surfaces ready to cover. At Philip Morris' request, Contractor shall replace the representative materials with materials finally approved by Philip Morris for installation in the Railcars.

3.1.3.9 The Railcars will have the air conditioning and ventilation systems as set forth in the Specifications. The parties acknowledge that smoking will be permitted on-board and that fire-retardant materials will be used throughout the Trainset where appropriate. Rate of rise type heat detectors will be used throughout the Trainset and fire extinguishers will be placed strategically throughout the Trainset. The car exteriors will have customized paints and bear logos developed by Philip Morris and applied by Contractor; Philip Morris shall deliver the logos to Contractor not later than five days after delivery by Contractor of the last Specification or Plan or Drawing, as the case may be, pursuant to Section 12.1.

3.1.3.10 The Trainset will meet Applicable Standards. Changes to the Applicable Standards shall be incorporated into this Agreement pursuant to Section 22 hereof, provided, however, that Contractor shall not be entitled to an increase in the Contract Price for costs incurred to comply with such changes unless such costs exceed $5000. Contractor will secure necessary approvals of design necessary to ensure compliance with the ADA. There will be two ADA cabins as well as an ADA elevator to allow for access to upper and lower levels of the cars.

3.2 <u>Review of the Work, Specifications, Approval Drawings</u>. Contractor agrees that the Specifications and Contract Drawings must be ~~further reviewed by Philip Morris in~~ accordance with Section 12. In the case of general arrangement drawings, system drawings, interior finish drawings and test memos (collectively the "Approval Drawings"), Contractor shall also submit the Approval Drawings to Philip Morris in accordance with Section 12. Contractor has identified in Schedule C the budget for all aspects of the Work that are not fully designed as of the execution date hereof. Contractor shall allow the Engineer such access to designs, work and facilities as may be necessary to review and approve the Work, Specifications and Contract Drawings. Review by the Engineer of any document submitted by Contractor shall not relieve Contractor of its responsibility to fully comply with the terms and conditions of this Agreement.

3.3 Letter Agreement. Any work performed pursuant to the Letter Agreement shall be deemed part of the Work for all purposes hereunder.

3.4 Track Rights. Contractor shall act as Philip Morris' agent to negotiate comprehensive track rights for the operation of the Marlboro Unlimited. The scope of the track rights required is set out in Schedule D. If requested by Contractor, Philip Morris shall provide assistance reasonably necessary to obtain such track rights. In no event shall Contractor enter into any agreements for track rights on behalf of Philip Morris. In the event track rights acceptable to Philip Morris, in its sole discretion, are not secured on or before December 31, 1994, Philip Morris may (1) extend the time for Contractor to complete such arrangements for comprehensive track rights, (2) take control of negotiating comprehensive track rights or (3) terminate this Agreement upon written notice to Contractor. Termination pursuant to this Section 3.4 shall be subject to the terms of Section 25.

4. Point of Contact. The Point of Contact shall coordinate the flow of communications within the Philip Morris organization as required to obtain authorizations, information and approvals during the performance of the Work. Where additional authorizations or approvals are required pursuant to this Agreement, Contractor shall not perform, and shall not be obligated to perform, any services without approval by the Point of Contact. Philip Morris may change the designated Point of Contact by written notice to Contractor.

5. Provisional Acceptance. Upon the completion of each Railcar and Modified Locomotive, Contractor shall notify Philip Morris that the Railcar or Modified Locomotive is ready and available for inspection and testing and the proposed schedule for testing. Testing procedures shall be those determined in accordance with Section 13. Thereafter, in accordance with the schedule provided by Contractor, the Engineer shall inspect and witness the testing of the Railcar or Modified Locomotive, and if the Railcar or Modified Locomotive, as the case may be, conforms to this Agreement, the Specifications and Contract Drawings in all respects, Philip Morris shall accept the Railcar or Modified Locomotive on a provisional basis. At Philip Morris' request, Contractor shall store any provisionally accepted Railcar at its facility and at no additional cost to Philip Morris.

If upon such inspection and testing and witnessing of any testing the Engineer determines that any Railcar or Modified Locomotive does not conform to this Agreement, the Specifications, or Contract Drawings, Philip Morris shall promptly notify in writing Contractor of the respects in which the Railcar or Modified Locomotive is deficient. Upon receipt of notice of any such deficiency, Contractor shall promptly take appropriate corrective action including, if required, replacing such materials and equipment and reperform such services as are necessary to complete the Railcar in accordance with this Agreement, the Specifications and Contract Drawings.

6. Philip Morris' Use of Provisionally Accepted Railcars. The parties acknowledge that, upon provisional acceptance, certain Railcars and Modified Locomotive(s) may be used by Philip Morris in promotional activities during the Interim Period. If Philip Morris uses any Railcars

or Modified Locomotive(s) in promotional activities during the Interim Period, Contractor shall provide maintenance for such Railcars during the Interim Period, such maintenance to be performed in accordance with a separate agreement and at a cost not to exceed Contractor's actual costs reasonably required to provide maintenance (including travel expenses incurred with Philip Morris' approval) plus 10% of such costs. Philip Morris shall return the Railcars and Modified Locomotives, if any, Philip Morris has removed from Contractor's facility on or before the operational trials conducted pursuant to Section 7, provided that Contractor has notified Philip Morris not less than 90 days prior to the anticipated date of such operational trials.

Philip Morris shall be obligated to return to the Contractor the provisionally accepted Railcars and/or Modified Locomotives in the same condition that they were delivered by Contractor to Philip Morris, ordinary wear and tear excepted. Nothing herein shall be deemed to obligate Philip Morris for damage or defects in the provisionally accepted Railcars and/or Modified Locomoties to the extent such damage or defects arise out of the actions or omissions of Contractor, Contractor's employees or agents. During the Interim Period, Philip Morris shall be obligated to maintain insurance on such Railcars and/or Modified Locomotives in such amounts and scope of coverage at least equal to that required of Contractor under the terms of this Agreement and Contractor shall be named as an additional insured thereon. Risk of loss to such provisionally accepted Railcars and/or Modified Locomotives shall pass from Contractor to Philip Morris at such time as Philip Morris obtains custody or control over such Railcars and/or Modified Locomotives.

7. <u>Delivery, Final Acceptance and Risk of Loss</u>. Upon provisional acceptance by Philip Morris of the last Railcar or Modified Locomotive, whichever occurs last, Contractor shall conduct operational trials to demonstrate to the Engineer that the Railcars and Modified Locomotive(s), when operating as a Trainset, conform to this Agreement, the Specifications and Contract Drawings. Operational trial procedures shall be determined in accordance with Section 13. Upon successful demonstration of such conformance, Philip Morris shall accept delivery of the Trainset. Contractor shall tender delivery of the Trainset at Contractor's rail siding in Denver, Colorado. If requested by Philip Morris, Contractor shall arrange for transportation of the Railcars to another delivery location specified by Philip Morris, at Philip Morris' cost in accordance with Section 22.

Philip Morris' use of some of the Railcars during the Interim Period shall not be deemed to excuse any failure to satisfy the operational trials, unless such failure is attributable solely to damage to the Railcars resulting from Philip Morris' negligence or the acts or omissions of persons or entities beyond Contractor's control. In the event Philip Morris does not return the Railcars by (a) the anticipated operational trial date (see Section 6) or (b) the date on which Contractor is ready to conduct operational trials, whichever is later, and such delay in return is not attributable to defects in the Railcars, such failure shall be deemed to be a waiver by Philip Morris to have such Railcars and Modified Locomotives operationally tested and Contractor shall conduct the operational trials using the remaining Railcars and such substitute railcars as may be necessary to satisfy the criteria of the operational trials. Operation trials conducted in accordance with the preceding sentence shall not prevent the Contractor from delivering to Philip Morris the balance of the Trainset nor shall it relieve Philip Morris of its obligation to accept the entire Trainset after Contractor demonstrates that the remaining Railcars operate as a Trainset to the extent permitted taking into account the absence of the non-returned Railcars and/or Modified Locomotives. To the extent that the cost of conducting operational tests is increased to accommodate the absence of Railcars or modified Locomotives, Philip Morris shall bear such additional costs of testing.

Final Acceptance of the Railcars shall occur when (a) Philip Morris accepts delivery of the Railcars or (b) Contractor delivers to Philip Morris all permits, licenses, certificates and other approvals that Contractor is required to obtain pursuant to the Contract Documents, whichever occurs later.

Contractor shall bear the risk of and be liable for loss of or damage to the Work and any Philip Morris property that may be in Contractor's custody and control, except to the extent that such loss or damage may be caused by Philip Morris' wilful misconduct or negligence or the wilful misconduct or negligence of its agents or employees. Risk of loss or damage shall pass to Philip Morris upon Final Acceptance or, with respect to individual Railcars and Modified Locomotives, upon removal by Philip Morris of the Trainset or any portion thereof from the control or custody of Contractor, whichever shall first occur.

8. <u>Identification of Components and Materials and Passage of Title</u>. As Contractor purchases materials and components that are to be incorporated into the Trainset or used in the performance of the Work, Contractor shall identify such materials and components as dedicated exclusively to the performance of this Agreement. Such identification may include such measures as Philip Morris may reasonably require to segregate the materials and equipment from other materials Contractor may have on hand, as well as labelling or other appropriate identification. Title to all materials and equipment purchased for incorporation into the Trainset or used in the performance of the Work shall pass to Philip Morris upon such identification to the Agreement. If Contractor takes title to the material and equipment prior to passage of title to Philip Morris, Contractor shall identify its purchase as one for resale only.

9. <u>Production Schedule</u>

9.1 Contractor acknowledges that Philip Morris has entered into this Agreement in reliance upon Contractor's representation that Contractor can deliver the Trainset and complete the Work in accordance with the schedule set out in Schedule E. Not later than 60 days after the execution of this Agreement, Contractor shall submit to Philip Morris and the Manufacturing Expert the modified Specifications, Contract Drawings and a modified production schedule for delivery of the Trainset and completion of the Work hereunder. In the event that the Manufacturing Expert determines that the modified production schedule does not present a feasible schedule for delivery of the Trainset and completion of the Work by April 1, 1996, and within five business days of receipt of such determination Contractor is unable to cause the Manufacturing Expert to determine that the applicable schedule is feasible, then Philip Morris may cancel this Agreement pursuant to Section 26. If the Manufacturing Expert determines that the modified Production Schedule is feasible, such modified Production Schedule shall be considered to be the Production Schedule for all purposes of this Agreement until subsequently modified in accordance with terms of this Agreement.

9.2 Time is of the essence with respect to the delivery of the Trainset and completion of the Work. Contractor shall deliver the Railcars and Modified Locomotive(s) and complete the Work in accordance with the Production Schedule. In no event shall Philip Morris be liable for any overtime premiums incurred by Contractor, except as provided for in the Cash Flow Projection in order to maintain the Production Schedule, provided that in no event shall such premiums be deemed to increase the Contract Price. Contractor's failure to deliver the Railcars, Modified Locomotive(s) or Trainset or to complete the Work by the Default Milestones shall be considered a material breach of Contractor's obligations hereunder. In the event that Contractor notifies Philip Morris not later than April 1, 1995 that delivery of the Trainset and completion of the Work cannot occur in accordance with the Production Schedule, such failure shall not be considered a breach of Contractor's obligations unless delivery of the Railcars and Modified Locomotive(s) and completion of the Work have not occurred by the twenty-second day after the Default Milestone dates specified in the Production Schedule.

9.3 The parties agree that Philip Morris will be damaged substantially and in an amount that will be difficult or impossible to determine if Contractor fails to deliver the Trainset or complete the Work as specified in the Production Schedule. Thus, in lieu of actual damages and notwithstanding any other provision in this Agreement to the contrary, Contractor shall pay Philip Morris as fixed, agreed and liquidated damages (and not as a penalty) the sum of $ 66,667 for each day or portion thereof (including Saturdays, Sundays and holidays) after the Final Delivery Date that Final Acceptance does not occur, but only to the extent such delay is unexcused pursuant to Section 23. The parties agree that $ 66,667 per day is a reasonable estimate of the damages Philip Morris will incur if Final Acceptance fails to occur by the Final Delivery Date. In the event that Contractor notifies Philip Morris not later than April 1, 1995 that Final Acceptance cannot occur by the Final Delivery Date, then for a period of 21 days after the Final Delivery Date the liquidated damages shall be reduced to $ 7,000 per day or portion thereof; provided, however, that if Final Acceptance fails to occur by the 21st day after the Final Delivery Date, the liquidated damages shall be $ 66,667 per day for each day or portion thereof thereafter. In no event shall the total liquidated damages payable by Contractor exceed $ 2,000,000.

Payment of such liquidated damages shall be Philip Morris' sole and exclusive remedy against Contractor for unexcused delay in delivery of Trainset or completion of the Work hereunder, but such liquidated damages are cumulative and in addition to other rights and remedies Philip Morris may have against Contractor for default or for damages suffered or incurred by Philip Morris for any reason other than Contractor's unexcused delay in the delivery of the Trainset or completion of the Work, including but not limited to damages due to defective Railcars, equipment or material furnished by Contractor.

Philip Morris may deduct any liquidated damages assessed pursuant to this Agreement from amounts due Contractor under this Agreement, provided, however, that Philip Morris shall not deduct such liquidated damages from payments due Contractor prior to Final Acceptance unless the total payments made by Philip Morris to Contractor exceed the Contract Price less $2,000,000. Contractor hereby waives any defense to Philip Morris' recovery of such liquidated damages on the basis that actual damages are ascertainable, that such liquidated damages do not represent a reasonable estimate of Philip Morris' damages or that such liquidated damages constitute a penalty.

9.4 The parties agree that it is in the best interests of the parties to deliver the Railcars and complete the Work before April 1, 1996. Accordingly, Philip Morris shall pay Contractor a bonus payment if Final Acceptance occurs before April 1, 1996, such bonus payment to be determined as follows: (1) for Final Acceptance occurring 42 calendar days or more in advance of April 1, 1996, the bonus payment shall be 2% of the Contract Price; and (2) for Final Acceptance occurring 21 calendar days or more in advance of April 1, 1996, but fewer than 42 calendar days in advance of the Final Delivery Date, the bonus payment shall be 0.75% of the Contract Price. In the event Philip Morris authorizes an adjustment to the Production Schedule pursuant to Section 22.1 or the Production Schedule is adjusted for suspension of the Work pursuant to Section 24, the April 1, 1996 date provided above shall be deemed delayed in accordance with such adjustment. In the event Contractor notifies Philip Morris pursuant to Section 9.2 that delivery of the Railcars and completion of the Work cannot occur in accordance with the Production Schedule and Philip Morris notifies Contractor within 60 days of such notice that Philip Morris plans to delay its Marlboro Unlimited promotion as the result of such anticipated failure to maintain the Production Schedule, the parties agree that early delivery will not benefit Philip Morris and Contractor shall not be entitled to a bonus payment for delivery in advance of April 1, 1996.

10. **Personnel.** The following individuals are "key personnel" for purposes of this Agreement: Thomas Rader, John Thompson, Jeffrey Schrecengost, and Stuart M. Novak. Contractor shall not permit such personnel to be reassigned or replaced without Philip Morris' prior written consent. In the event any individual identified as key personnel ceases to be employed by Contractor and Contractor fails or refuses to replace such individual with another qualified person reasonably acceptable to PM, then PM may cancel this Agreement pursuant to Section 15.

11. **Compensation.** In consideration of the performance of the Work, Philip Morris shall pay to Contractor the fixed sum of $ 27,860,000 (the "Contract Price"). The Contract Price may be modified from time-to-time as provided herein and as so modified shall be deemed to be the Contract Price for all purposes of this Agreement. Except as provided elsewhere in this Agreement, the Contract Price is the entire compensation due Contractor for performance of all of the Work described in this Agreement. Contractor shall be fully responsible for any costs associated with performance of the Work, changes to the Work and warranty and remedial obligations under this Agreement, including but not limited to all taxes that may be imposed on Contractor in connection with this Agreement or its performance, except applicable sales or use

taxes, value added taxes or import duties. To the extent Philip Morris is not exempt from any such sales, or use taxes or value added taxes or import duties, Philip Morris shall reimburse Contractor for any such taxes or duties that Contractor may be required to collect and pay in connection with this Agreement. Philip Morris shall provide Contractor evidence of any tax exemptions that may be applicable. Philip Morris hereby agrees to indemnify, defend and hold Contractor harmless from any and all sales tax liabilities, and any interest and penalties associated therewith that may be imposed on Contractor as a result of Philip Morris' wrongful failure to make payment to Contractor hereunder.

Any amounts paid by Philip Morris to Contractor pursuant to the Letter Agreement shall be credited as payments against the Contract Price, such credit to be allocated to payments to be made by Philip Morris pursuant to Section 11.1. Philip Morris shall confirm in writing amounts paid pursuant to the Letter Agreement.

In the event Philip Morris exercises its right pursuant to Section 3.1.2 to remove the modification of the Locomotives from the Work, the Contract Price shall be reduced by $ 360,000. In the event Philip Morris requests that the materials used in the mockups described in Section 3.1.3.8 be replaced with materials finally approved by Philip Morris, then the Contract Price shall be increased by the actual cost of such materials used in such mockups. In the event Philip Morris exercises its right pursuant to Section 3.1.2 to include in the Work the modification of three or more Locomotives, the Contract Price shall be increased by $ 180,000 for each additional Locomotive.

11.1 <u>Installments</u>

The Contract Price shall be payable in accordance with Section 11.2 in the following installments:

11.1.1 <u>Railcar Payments</u>. Philip Morris shall pay Contractor a portion of the Contract Price as compensation to Contractor for the purchase of the used railcars that will be used as the base for the Railcars (as are identified in Schedule F hereto) as follows: (1) $95,000 each for 13 bi-level railcars, (2) $50,000 for one single level baggage railcar, (3) $40,000 for one single level railcar and (4) the actual cost incurred by Contractor FOB its plant in Denver, Colorado for three single level railcars.

11.1.2 <u>Progress Payments</u>. Philip Morris shall pay Contractor additional portions of the Contract Price in amounts sufficient to reimburse Contractor for the actual costs incurred by Contractor for other equipment and materials to be incorporated into the Trainset or used in the performance of the Work on a bi-weekly basis as those costs are incurred and the materials and equipment are received and identified to the Agreement (see Section 8). If Contractor has been required to pay deposits as a condition of placing an order for equipment and materials to be incorporated into the Trainset or used in the performance of the Work, then Philip Morris shall also pay Contractor additional portions of the Contract Price in amounts sufficient to reimburse Contractor for the actual cost of such deposits.

Philip Morris shall pay Contractor for the services provided hereunder on (a) a bi-weekly basis during the progress of the Work for actual labor expenses incurred during the preceding two weeks and (b) a monthly basis during the progress of the Work for actual overhead expenses incurred during the preceding month. Expenses shall be limited to those identified in Schedule C hereto. In no event shall Philip Morris be obligated to make any payment to Contractor that when added to all previous payments exceed the Contract Price.

If the sum of the total amount of payments made by Philip Morris and the amount of any proposed payment set out in an Application for Payment exceeds the cumulative amount reflected in the Cash Flow Projection by more than 10% or, if upon completion of any Railcar the total amount of payments allocable to such Railcar made by Philip Morris and the amount of any proposed payment set out in any Application for Payment allocable to such Railcar exceed the total amount in the Cash Flow Projection for such Railcar by more than 10%, then, unless Contractor submits a restated cash flow projection reasonably acceptable to Philip Morris, Philip Morris shall (a) have no liability for such excess and (b) have the right to cancel this Agreement pursuant to Section 26.1.2. Philip Morris' acceptance of any revised cash flow projection shall not be effective unless provided in writing. If Philip Morris accepts Contractor's restated cash flow projection, the Cash Flow Projection shall be deemed to incorporate such restatement.

11.1.3 Final Payment

11.1.3.1 Philip Morris shall pay Contractor any balance of the Contract Price previously unpaid upon Final Acceptance of the Trainset (see Section 7). Philip Morris acknowledges that the amount of the Contract Price allocated to final payment represents a portion of the Contractor's profit on the Work and is ratably "earned," but not payable, in accordance with the progress of the Work. In addition to the previously unpaid balance of the Contract Price, Philip Morris shall pay Contractor as part of the final payment the bonus payment, if any, payable to Contractor pursuant to Section 9.4. The final payment shall be subject to Philip Morris' right to withhold payments pursuant to Section 11.1.3.2 and Section 11.3.

11.1.3.2 Philip Morris may withhold from the final payment due Contractor an amount equal to 110% of the cost reasonably estimated to complete any item of Work that Philip Morris has agreed may be completed after Final Acceptance, which amount shall be ~~payable to Contractor only upon the satisfactory completion of such Work; provided, however,~~ that if Contractor delivers to Philip Morris a retention payment bond in form and substance and with such surety as shall be acceptable to Philip Morris, Philip Morris shall not withhold such amount from the final payment. In addition, Philip Morris may withhold from the final payment due Contractor an amount equal to 2% of the Contract Price, such amount to be paid to Contractor upon delivery of the as-built drawings pursuant to Section 12.8.

11.1.3.3 Philip Morris shall convey to Contractor, and without cost to Contractor, materials and equipment that were used in the performance of the Work, but not incorporated into the Trainset upon Final Acceptance.

11.2 Application for Payment and Payment.

11.2.1 Contractor may prepare and submit bi-weekly Applications for Payment for base railcars, other equipment and materials upon receipt and identification to the Agreement of the base railcars and other items of equipment and materials to be incorporated into the Trainset or used in performance of the Work, and for documented deposits made by Contractor as a condition for placing an order for equipment and materials to be incorporated into the Trainset or used in the performance of the Work; provided, however, that any materials received after the 10th or 25th of any month shall be included in the Application for Payment for the next two-week period. Such Applications for Payment shall be supported by documents that verify the receipt by Contractor of such base railcars and other items of equipment or materials, as the case may be.

11.2.2 Contractor may prepare and submit bi-weekly Applications for Payment of progress payments, provided, however, that Contractor shall not include overhead expenses in Applications for Payment submitted prior to the end of the month in which such overhead expenses are incurred. Each such Application for Payment shall be certified by an authorized officer of Contractor and shall contain a detailed itemized description of the Work performed during the preceding two weeks and, if applicable, the overhead expenses incurred during the preceding month, including original invoices, copies of payroll registers, payroll records, progress reports detailing copies of completed, proposed schedule revisions, the documentation required pursuant to Section 11.2.4.1 and such other documents reasonably acceptable to Philip Morris that verify the costs identified in the Application for Payment.

11.2.3 On or after Final Acceptance, Contractor may prepare and submit an Application for Payment of the final payment. The Application for Payment for shall be certified by an authorized officer of Contractor and shall contain a detailed itemized description of the Work performed since the last Application for Payment and, if applicable, the overhead expenses incurred since the last Application for Payment, including original invoices, copies of payroll registers, payroll records, the documentation required pursuant to Section 11.2.4.2 and such other documents reasonably acceptable to Philip Morris that verify the costs identified in the Application for Payment.

11.2.4 Philip Morris shall pay to Contractor the amount of any Application for Payment by check or bank transfer of funds within 10 days after receipt of Contractor's Application for Payment submitted in accordance with Sections 11.2.1, 11.2.2 and 11.2.3, as the case may be. Philip Morris shall have the right to request additional supporting documentation or further explanation of, and to dispute any matter set forth in any Application for Payment, provided that such dispute is in good faith. If Philip Morris shall dispute any Application for Payment, Philip Morris shall pay the amount of the payment that is not in dispute. Contractor may submit a revised Application for Payment in response to Philip Morris' refusal to approve an original Application for Payment. All amounts received by Contractor shall be held in trust for the payment of any subcontractor to whom payment has not been made for labor, equipment, or materials.

11.2.4.1 Contractor's right to receive equipment and materials payments and progress payments shall be conditioned upon Contractor's prompt and complete payment of all amounts due to its employees and subcontractors, including suppliers of labor and materials. Contractor shall furnish with each such Application for Payment:

(a) an affidavit, in a form approved by Philip Morris, showing the names and addresses of all persons or firms that have furnished labor, material or supplies for the performance of the Work and the amount due to each of them; and

(b) receipts, releases and waivers of liens from Contractor and all subcontractors and suppliers performing Work compensable on a cumulative basis of more than $5,000 in such form as may be requested by Philip Morris in order to establish the payment or discharge by Contractor of its obligations hereunder or to third parties in connection with the performance of the Work since the last Application for Payment; provided, however, that if any such person shall refuse to furnish a receipt, release or waiver required by Philip Morris, Contractor may furnish a bond or other instrument mutually acceptable to Contractor and Philip Morris to indemnify Philip Morris against any such lien in lieu of such releases and waivers .

11.2.4.2 Contractor's right to receive final payment shall be conditioned upon Contractor providing to Philip Morris the following information (which information shall be stated as of a date not more than five business days prior to the date of the final Application for Payment):

(a) an affidavit in the form provided by Philip Morris certifying that all payrolls, salary burdens, social security payments, invoices of subcontractors, invoices for materials and equipment and other indebtedness connected with the Work for which a claim against Philip Morris, or the Railcars or Modified Locomotive(s) may in any way be made or asserted to have been paid or otherwise satisfied or provided for by a bond or other instrument satisfactory to Philip Morris;

(b) receipts, releases and waivers of liens from Contractor and all subcontractors and suppliers performing Work compensable at more than $5,000 in such form as may be requested by Philip Morris in order to establish the payment or discharge by Contractor of its obligations hereunder or to third parties in connection with the performance and completion of the Work; provided, however, that if any such person shall refuse to furnish a receipt, release or waiver required by Philip Morris, Contractor may furnish a bond or other instrument mutually acceptable to Contractor and Philip Morris that operates to discharge such lien.

11.2.5 No payments made by Philip Morris to Contractor shall be considered evidence of satisfactory performance of the Work by Contractor in whole or in part, nor shall such payments relieve Contractor of its obligation to perform the Work in strict compliance with the terms of this Agreement.

11.3 <u>Philip Morris' Right to Withhold Payments</u>.

11.3.1 If any Contractor Default (see Section 26) has occurred and is continuing, Philip Morris shall have the right to retain out of any amount payable to or for the account of Contractor an amount sufficient to provide Philip Morris security for the performance of the obligations of Contractor under this Agreement as a result of such Contractor Default. At such time thereafter as no Contractor Default is continuing, such amount (less any damages Philip Morris shall have incurred as a result of the Contractor Default) shall be paid promptly to Contractor.

11.3.2 If any person or entity asserts a claim or lien against Philip Morris, the Railcars, the Modified Locomotive(s) or any other property of Philip Morris, which claim or lien is chargeable or related to Contractor's performance of the Work, Philip Morris shall have the right to retain out of any payments due or to Contractor an amount sufficient to protect Philip Morris fully from all claims, losses, damages and expenses related to such claim or lien until the lien has been removed or the claim has been terminated or released to Philip Morris' satisfaction. In the event Contractor furnishes a bond or other instrument mutually acceptable to Contractor and Philip Morris to indemnify Philip Morris against any such lien, Philip Morris shall not withhold payments as protection against such lien pursuant to this Section 11.3.2; provided, however, that if any such lien or claim remains unsatisfied on or after Final Acceptance, Philip Morris shall have the right to retain out of any payments due to Contractor an amount sufficient to protect Philip Morris against all monies that Philip Morris may be compelled to pay in discharging such lien or claim, including all costs and reasonable attorneys' fees.

11.3.3 Philip Morris' right to withhold monies pursuant to this Section 11.3 is in addition to any other rights and remedies available to Philip Morris under Section 11.1.3.2 or elsewhere under this Agreement or provided by law.

12. **<u>Specifications, Drawings, Samples and Models</u>**

12.1 <u>Submission of Specifications and Contract Drawings</u>. Within 60 days of the execution of this Agreement, Contractor shall make available to Philip Morris modified Specifications and Contract Drawings required for the Work. Philip Morris' Engineer shall review the Specifications and Contract Drawings, but such review shall not relieve Contractor of its responsibility for preparing and submitting proper Specifications and Contract Drawings in accordance with the Agreement.

Contractor acknowledges that Philip Morris has not reviewed in detail the Specifications and Contract Drawings. Philip Morris's Engineer shall complete its review of the Specifications and Contract Drawings submitted prior to the execution of this Agreement pursuant to the terms of this Section 12, provided, however, that any applicable period for Philip Morris' review provided herein shall be deemed to be 60 days from the date of execution hereof.

12.2 Procedure after Submission. Approval Drawings (modified general arrangement drawings, systems drawings, interior finish drawings and test memos). Approval Drawings, will be returned to Contractor with an indication of the action taken. Philip Morris shall notify Contractor within two business days after Approval Drawings are made available to Engineer of the action taken with respect to the Approval Drawings; provided, however, that for Approval Drawings relating to the systems, Philip Morris shall notify Contractor within five business days after such systems drawings are made available to Philip Morris of the action taken with respect to the systems drawings.

12.3 Submission of Approval Drawings, Shop Drawings, Samples and Models.

12.3.1 Before commencing the various portions of the Work, Contractor shall notify Philip Morris that the applicable Approval Drawings, Shop Drawings, Samples and models required for use or called for in the various parts of the Specifications are available for the review by Engineer. Any Work commenced on any item affected by such Approval Drawings, Shop Drawings, Samples or models prior to Contractor's receipt of all necessary written approvals of Approval Drawings, Shop Drawings, Samples and models in accordance with this Section 12 shall be at Contractor's sole risk and expense. All such items shall be submitted in accordance with the Production Schedule and so as to cause no delay in the progress of the Work. No extensions of time will be granted to Contractor because of its failure to submit Approval Drawings, Shop Drawings, Samples or models in time for review. Review of such items by Engineer shall not relieve Contractor of its responsibility for preparing and submitting proper Shop Drawings in accordance with the Agreement.

12.3.2 Shop Drawings submitted for review must bear the stamp of Contractor stating that they have been checked. It is the responsibility of Contractor to check all Shop Drawings fully for arrangement and conformance with the applicable Contract Drawings and Specifications and for accuracy of dimensions. If it appears that such checking has been inadequate or careless, even though the drawings are stamped as having been checked, the drawings shall be returned to Contractor for proper checking before further processing by Engineer.

12.3.3 Shop Drawings, Samples and Models shall be processed using the procedures set out in Section 12.2.

12.4 <u>Return of Contractor's Submissions</u>

12.4.1 If Specifications, Approval Drawings, Contract Drawings, Shop Drawings or other materials are returned to Contractor stamped "Conforming" or "Conforming, as Noted," Contractor may immediately proceed with the Work, taking any corrections noted into account. If the Specifications, Contract Drawings, Approval Drawings, Shop Drawings or materials are stamped "Returned for Corrections," "Not Conforming," Contractor shall not proceed with the Work but shall make the corrections and resubmit the revised Specifications, Approval Drawings, Contract Drawings, Shop Drawings or other materials to Engineer. If Contractor takes exception to any marked revisions, Contractor shall promptly notify Engineer.

12.4.2 If Contractor takes exception to any marked revisions with respect to technical issues and Engineer does not agree with Contractor, the technical specification shall be submitted to a third party for resolution (the "Technical Arbiter"). The decision of the Technical Arbiter shall be final and, if the Technical Arbiter approves Contractor's exception, the Specifications, Approval Drawings, Contract Drawings, Shop Drawing or other material shall be marked, "Conforming." No decision of the Technical Arbiter or corrections noted by Engineer shall be deemed to constitute a change in the scope of Work hereunder or provide a basis for a change order pursuant to Section 22.

12.4.3 If Contractor takes exception to any marked revisions with respect to non-technical issues (<u>i.e.</u>, interior design or aesthetic specifications) identified in any Specifications, Approval Drawings, Contract Drawings, Shop Drawings or other materials, then Contractor shall make the corrections and resubmit the revised Specifications, Approval Drawings, Contract Drawings, Shop Drawings or other materials to Engineer. If the cost of completing that portion of the Work in accordance with the resubmitted Specifications, Approval Drawings, Contract Drawings, Shop Drawings or other materials exceeds the budgeted amount for such specification set out in Schedule C, the Contract Price shall be increased by the difference between the budgeted amount and the actual cost; provided, however, that the Contract Price shall increase only to the extent that such difference cannot be offset by cost savings incurred as a result of Philip Morris' corrections or changes to Specifications, Approval Drawings, Contract Drawings, Shop Drawings or other materials that decrease the cost of completing other portions of the Work below the budgeted amount for such Specification as set out in Schedule C.

12.5 <u>Review by Engineer and Others</u>. Any review of Specifications, Approval Drawings, Contract Drawings and Shop Drawings by Engineer or any other consultant will be general only. No such party need verify dimensions and review is not to be interpreted as checking of detailed dimensions or approval of deviations from Contract Drawings and Specifications, unless Contractor has specifically requested such a check or approval of a deviation at the time of submittal. All deviations will be highlighted on the Shop Drawings or Approval Drawings and in Contractor's letter of transmittal. No review of Specifications, Approval Drawings, Contract Drawings or Shop Drawings will relieve Contractor of its responsibility for their accuracy and compliance with the Contract Documents or the furnishing of all materials required by the Agreement, Specifications, or Contract Drawings, even though the same may not be indicated on the Shop Drawings or Approval Drawings, or from the responsibility for proper execution of the Work, or from any other Contract Document obligations. The review of Specifications, Approval Drawings, Contract Drawings or Shop Drawings does not authorize changes from the requirements of the Contract Documents as to materials, workmanship, scope of the Work or Contract Price, unless authorized by a change order pursuant to the provisions of Section 22.

12.6 Manufacturers' Descriptive Data. If manufactured items are shipped to Contractor with descriptive data, installation instructions, part numbers and the like, Contractor will turn over two copies of such literature to Engineer for each item of which two or more are incorporated into the Work and one copy for each item of which only one is incorporated into the Work.

12.7 Alternates. Where the Contract Drawings or Specifications permit Contractor to supply alternate acceptable materials, Contractor shall include with its Shop Drawings of such alternate materials the Specification or Plans or Drawings permitting the alternate, and the Shop Drawings shall be clearly marked "For Comparison Purposes Only."

12.8 Record Drawings. Contractor shall maintain a set of record drawings showing all Work as it is completed, current Contract Drawings and Specifications, bulletins and Shop Drawings, all marked to show changes made during construction. These documents shall be kept in good order and shall be available to Engineer at all times. Within 60 days after Final Acceptance, Contractor shall provide a complete set of as-builts record drawings to Philip Morris.

12.9 Philip Morris Response. The failure of Philip Morris to respond within the time limits specified in this Section 12, Contractor shall be entitled to an extension of the Production Schedule for the completion of the affected obligations hereunder to the extent that, and only so long as, Philip Morris' failure to respond prevents Contractor's performance thereof.

12.10 Limitation. The Contract Drawings and Specifications and Shop Drawings shall at all times be subject to the provisions of Section 21 hereof. The restriction imposed by this Section 12.10 shall survive the termination or cancellation of this Agreement for any reason.

13. **Acceptance Testing. Testing procedures and operational trial procedures for Provisional** Acceptance and Final Acceptance, respectively, shall be determined as follows: (a) if there are existing procedures and standards for the railroad passenger industry, such procedures and standards shall be used unless the parties mutually agree to more stringent procedures and standards and (b) if there are none, the parties shall mutually agree upon such procedures and standards. Any tests for Provisional Acceptance of individual Railcars pursuant to Section 5 shall include demonstration of the functionality of any system designed to interconnect with other Railcars during the operation of the Trainset. In the event the parties are unable to agree upon (a) testing procedures for Provisional Acceptance on or before March 1, 1995 or (b) operational trial procedures for Final Acceptance on or before September 1, 1995, alternative proposals shall

be submitted to the Technical Arbiter for prompt and immediate resolution, whose decision shall be final as to the resolution of such testing procedures and operational trial procedures.

14. Contractor's Warranties and Remedies

14.1 Warranties

14.1.1 Contractor warrants that the each Railcar, the Modified Locomotives (to the extent modified by Contractor hereunder) and each item of material and equipment supplied hereunder shall be new or, if specifically provided otherwise in the Specifications, warranted as new, and shall conform strictly to the description set forth in the Contract Documents contained herein.

14.1.2 Contractor warrants as follows:

14.1.2.1 That for a period of one year from the date of Final Acceptance of the Trainset (or two years if the time period is extended pursuant to Section 14.3), the Trainset and each Railcar and Modified Locomotive (to the extent modified by Contractor hereunder) and each item of material and equipment supplied hereunder shall be free from defects in design (unless the design is provided by Philip Morris), workmanship and materials. Contractor assumes and acknowledges full and complete responsibility for the suitability, adequacy and safety of the design, manufacture and fabrication of equipment designed or furnished by Contractor or its subcontractors.

14.1.2.2 That for 250,000 miles, the entire car structure of each Railcar including the underframe thereof shall be free from defects in design (unless the design is provided by Philip Morris) workmanship and materials.

14.1.2.3 That for 250,000 miles, the truck frames of each Railcar shall be free from defects in design (unless the design is provided by Philip Morris), workmanship and materials.

14.1.2.4 That the Trainset and each Railcar and Modified Locomotive (to the extent modified by Contractor hereunder) shall perform as required by the Contract Documents ~~including standards for sway levels, shock absorption~~, and maximum ~~decibel levels~~ for exterior and car-to-car and cabin-to-cabin internal noise conduction, and in accordance with the Applicable Standards. Contractor warrants further that the Railcars shall have a ride quality, comfort level and noise level comparable to (a) existing "Ultradome" railcars currently in operation in the United States and as described in Schedules G and H hereto or (b) existing standard passenger railcars currently in operation in the United States, whichever standard is more stringent.

14.1.3 Without limiting the obligations of Sections 14.1.1 and 14.1.2, contemporaneously with the expiration of the one or two year period, as the case may be, set out in Section 14.1.2, Contractor shall assign to Philip Morris any and all manufacturer's warranty on materials or equipment Contractor has supplied hereunder. After such assignment, Contractor shall provide Philip Morris with such assistance as may be reasonably necessary to enforce such warranties, at Philip Morris' cost. Except to the extent Philip Morris requests Contractor's assistance as provided in the foregoing sentence, upon such assignment, and without any further action being required hereunder, Contractor shall be released from no further obligations to Philip Morris under this Article 14.1.3 with respect to matters accruing after such assignment and which are covered by such assigned warranties and Philip Morris shall look only to the manufacturer whose warranty was assigned to it for repair of such warrantied items accruing after such assignment.

14.1.4 Contractor warrants that any services provided hereunder shall (a) be performed in accordance with all conditions and requirements contained herein and (b) reflect the level of skill, knowledge and judgment required or reasonably expected of suppliers of comparable services.

14.1.5 Contractor warrants that the title to all items of material and equipment provided hereunder shall be good, and their transfer rightful, and that the items shall be free from all security interests, claims, demands, liens and other encumbrances. Contractor shall do, execute, acknowledge and deliver, or cause to be done, executed, acknowledged and delivered, any such further acts, instruments, papers and documents as may be necessary to transfer good title to Philip Morris to such items of material and equipment.

14.2 <u>Remedies</u>.

14.2.1 If Philip Morris discovers that the Trainset, any Railcars, the Modified Locomotive(s) or any item of material or equipment supplied or services performed by Contractor hereunder fails to conform to the above warranties, then Contractor shall, at no cost to Philip Morris, promptly repair, replace or modify any of the Trainset, Railcars, the Modified Locomotive(s) or parts and components thereof or correct or reperform any service so that it conforms to the above warranties, provided Philip Morris shall give Contractor written notice of the nonconformity within a reasonable time after discovery and in no event later than 12 months after Final Acceptance. Contractor shall provide all labor, engineering, field service representation, equipment, tools and materials necessary to gain access to and correct the ~~nonconforming condition and shall bear all expenses (including labor costs) in connection~~ therewith. The cost of transporting repaired, replaced or modified items of material or equipment to and from the Trainset shall be borne by Contractor.

The repaired, replaced or modified part or component and the reperformed services shall be covered by the warranty given above, and nonconforming conditions shall be subject to this remedy for the remainder of the original period specified above or six months after completion of the repair, replacement, modification or reperformance (as applicable), whichever is longer.

14.2.2 If any item of material or equipment fails to conform to the warranty set out in Section 14.1.5, Contractor shall defend the title thereto and shall, at Philip Morris' option and at no cost to Philip Morris, promptly remove any security interest, claim, demand, lien or other encumbrance or shall replace the item of material or equipment with an item conforming to the above warranty without regard for the period within which such non-conformity is discovered.

14.2.3 Contractor shall perform its remedial obligations hereunder in a timely manner consistent with Philip Morris' reasonable requirements. If Contractor is unable to remedy such nonconformity during a time period consistent with Philip Morris' requirements, Philip Morris may undertake to remedy the nonconformity and in such case Contractor shall reimburse Philip Morris for any reasonable expenses thereby incurred.

14.3 Extended Warranty. At Philip Morris' option, such option to be exercised, if at all, in writing within 15 business days of receipt of Contractor's notice of anticipated operational trials pursuant to Section 6, the period of the remedy provided in Section 14.2.1 shall be 24 months. The price payable by Philip Morris for such extension of the warranty period shall be $525,000; provided, however, that in the event Philip Morris solicits bids from third party providers of the warranty services described herein for such additional twelve-month period, Contractor shall have the right of first refusal with respect to the provision of such services at a price equal to or less than such third party bid.

14.4 Exclusivity of Warranties. THE WARRANTIES SET FORTH HEREIN ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER WARRANTIES WHETHER STATUTORY, EXPRESS OR IMPLIED (INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OF TRADE).

15. Representations

15.1 Philip Morris represents to Contractor the following:

15.1.1 Philip Morris has all necessary power and authority to execute, deliver and perform its obligations under this Agreement, and each of the execution, delivery and performance by Philip Morris of this Agreement has been duly authorized by all necessary action on the part of Philip Morris and requires no additional consent to be effective;

15.1.2 This Agreement constitutes a legal, valid and binding obligation of Philip Morris enforceable against it in accordance with its terms except to the extent that enforcement thereof may be limited by applicable bankruptcy, reorganization, insolvency or moratorium laws affecting the enforcement of creditors' rights or by the principles governing the availability of equitable remedies; and

15.1.3 Philip Morris is financially solvent, able to pay its debts as they mature, and possesses sufficient working capital to complete its obligations under this Agreement.

15.2 Contractor represents to Philip Morris the following:

15.2.1 Contractor has all necessary power and authority to execute, deliver and perform its obligations under this Agreement, and each of the execution, delivery and performance by Contractor of this Agreement has been duly authorized by all necessary action on the part of Contractor and requires no additional consent to be effective;

15.2.2 This Agreement constitutes a legal, valid and binding obligation of Contractor enforceable against it in accordance with its terms except to the extent that enforcement thereof may be limited by applicable bankruptcy, reorganization, insolvency or moratorium laws affecting the enforcement of creditors' rights or by the principles governing the availability of equitable remedies; and

15.2.3 Contractor is financially solvent, able to pay its debts as they mature, and possesses sufficient working capital to complete its obligations under this Agreement.

16. Production Capacity

16.1 Contractor shall maintain sufficient resources at its facility to ensure an adequate supply of labor, materials and space to complete the Work in accordance with the Production Schedule and the Contract Price. Contractor shall identify specific individuals as exclusively devoted to the provision of labor and supervision for the Work. Nothing herein shall be deemed to restrict Contractor's ability to add resources other than those identified to the Work.

16.2 Contractor shall give priority in the on-going work at its facility to the Work. Contractor shall include in any agreements executed after the effective date hereof a provision requiring that the parties agree that Contractor may reallocate resources in order to satisfy its obligations pursuant to this Agreement. The foregoing shall not apply to contracts executed for the provision of three railcars to Princess Tours and Great Canadian Railroads, which represent commitments made prior to the execution of this Agreement.

17. Liability Insurance. Contractor and its subcontractors and suppliers shall obtain and maintain the following insurance:

17.1 Statutory workers' compensation coverage in accordance with the law of the state where Contractor's facilities are located and any other states where Contractor will perform services hereunder.

17.2 Employer's liability with a limit of not less than $1,000,000; subcontractors shall maintain employer's liability with a limit of not less than $1,000,000.

17.3 Comprehensive general liability, including coverage for products and completed operations (for two years after performance hereof) and contractual liability, with a combined single limit of not less than $2,000,000 per occurrence.

17.4 Comprehensive automobile liability with a combined single limit of not less than $1,000,000 per occurrence covering all vehicles of Contractor whether owned, non-owned or hired.

17.5 Contractor shall obtain and maintain "key man" life insurance on Thomas Rader in an amount not less than $3,000,000.

Within 10 days of execution of this agreement, Contractor shall furnish certificates of insurance in a form reasonably acceptable to Philip Morris and issued by a carrier with an AM Best rating of at least "A" evidencing that the above insurance is in effect and otherwise complies with the requirements of this Section. Contractor shall require its comprehensive general and automobile liability insurers to name Philip Morris as an additional insured and such policies shall state that same is primary insurance and any other insurance carried by or self-insurance program maintained by Philip Morris shall be considered as excess insurance on behalf of Philip Morris only. Contractor shall require all its insurance carriers to (1) waive all rights of subrogation against Philip Morris and (2) give Philip Morris 30 days written notice of any material change or alteration in or cancellation of any policy of insurance required hereunder.

18. **Contractor's Indemnity**. Contractor shall defend, indemnify and hold harmless Philip Morris and Philip Morris' directors, officers, agents and employees from and against all claims, losses, liabilities, damages and expenses (including reasonable attorneys' fees) for personal injury to or death of persons (including but not limited to Philip Morris' employees) and damage to Philip Morris' property or facilities or the property of any other person or corporation in any manner to the extent proximately arising out of the negligence or misconduct of Contractor, its agents or employees or Contractor's subcontractors or subcontractors' employees.

Contractor shall indemnify and hold harmless Philip Morris from all liens and claims filed or asserted by Contractor or Contractor's subcontractors or suppliers against Philip Morris or Philip Morris' property or facilities for services performed or material or equipment furnished by Contractor, its subcontractors and suppliers in connection with the material, equipment or services supplied hereunder and from all losses, expenses, costs, causes of action or suits arising out of any lien or claim. Contractor shall, at its option and at no cost to Philip Morris, promptly discharge or remove any lien or claim by bonding, payment or otherwise and shall notify Philip Morris promptly when it has done so. If Contractor does not cause any lien or claim to be released or discharged by payment or bonding, Philip Morris shall have the right (but shall not be obligated) to pay all sums necessary to obtain releases and discharges (including but not limited to the settlement of any lien or claim) and to deduct all amounts so paid (plus reasonable attorneys' fees) from the amount due Contractor.

19. <u>Philip Morris' Indemnity</u>. Philip Morris shall defend, indemnify and hold harmless Contractor and Contractor's directors, officers, agents and employees from and against all claims, losses, liabilities, damages and expenses (including reasonable attorneys' fees) for personal injury to or death of persons (including but not limited to Contractor's employees) and damage to Contractor's property or facilities or the property of any other person or corporation in any manner to the extent proximately arising out of the negligence or misconduct of Philip Morris or its agents or employees.

20. <u>Property Damage Insurance</u>.

20.1 During the performance of the Work through Final Acceptance, Contractor shall provide "all risk" builders' risk insurance in an amount to include coverage for 100% of the full replacement value of the Work in progress, the equipment, including the base railcars, and materials for incorporation into the Railcars and Modified Locomotives, and any other Philip Morris property within Contractor's care, custody and control (the "Covered Items").

The limits of insurance to be maintained shall be in amounts not less than $25,000,000 at the installation site, $500,000 any other location, $2,000,000 while in transit and $25,000,000 for all covered property. The policy deductible shall not exceed $10,000 per occurrence.

Contractor shall report to its insurance carrier on a monthly basis 100% of the full replacement value of the Work in progress.

20.2 All such insurance shall identify Philip Morris as a loss payee as its interests may appear and waive the insurer's rights of subrogation against Philip Morris and its officers, directors, employees and agents for any loss or damage to the Covered Items. Contractor shall be liable for any deductible. In the event the Covered Items are damaged or destroyed, the proceeds of the insurance required herein shall be held in trust for the repair, restoration or replacement of the Covered Items. In the event Philip Morris elects not to repair, restore or replace the Covered Items or to terminate this Agreement with respect to those Covered Items pursuant to Section 25 as the result of such damage or loss, the proceeds of such insurance shall be paid to Philip Morris.

20.3 Contractor shall furnish certificates of insurance in a form reasonably acceptable to Philip Morris and issued by a carrier with an AM Best rating of at least "A" evidencing that the above property insurance is in effect and otherwise complies with the requirements of this Section 20. Contractor shall require its insurance carriers to give Philip Morris 30 days written notice of any material change or alteration in or cancellation of any policy of insurance required hereunder. Maintenance of the property insurance required by this Section shall not be deemed to relieve Contractor of any other obligation hereunder.

21. Patents, Trademarks, Trade Secrets and Copyrights

21.1 Contractor hereby grants Philip Morris a non-exclusive license to use the image of the domed railcar as described in the Specifications and any drawings, designs and other intellectual property rights reasonably necessary to use such image in Philip Morris' advertising and promotional activities, including but not limited to the construction of not more than 25 model Railcars, and such other promotional items as Philip Morris may require.

21.2 Contractor shall, at its expense, defend any suit or proceeding brought against Philip Morris in which it is alleged that any material, equipment or services, or any part thereof furnished hereunder, or use thereof for their intended purpose, constitute an infringement of any patent, trademark, trade secret or copyright, except to the extent that such claim arises out of Philip Morris' unapproved alterations of Contractor's Specifications; provided Philip Morris notifies Contractor in writing and gives Contractor authority and information and assistance reasonably requested by Contractor for the defense of the suit or proceeding. Contractor shall (a) pay all damages and costs (including reasonable attorneys' fees) awarded in any suit or proceeding so defended and (b) indemnify Philip Morris against any out-of-pocket expenses incurred by Philip Morris in providing information and assistance to Contractor for the defense of the suit or proceeding. Contractor shall not be responsible for the settlement of any suit or proceeding made without its written consent. If the material, equipment or services, or any part thereof, as a result of any suit or proceeding so defended, are held to constitute infringement of any patent, trademark, trade secret or copyright and their use by Philip Morris is enjoined, Contractor shall, at Philip Morris' option and at no cost to Philip Morris, either (a) procure for Philip Morris the right to continue using the material, equipment or services, or any part thereof, (b) replace them with substantially equivalent non-infringing material, equipment or services or (c) modify them so they become non-infringing but remain substantially equivalent. These provisions shall not apply to the extent that the material, equipment and services, or any part thereof, are (a) supplied in accordance with Philip Morris' design or specifications where compliance therewith has caused Contractor to deviate from its normal course of performance, (b) modified by Philip Morris or (c) combined by Philip Morris with items not furnished hereunder and a suit or proceeding is brought against Philip Morris solely by reason of said design, instruction, modification or combination.

22. Changes.

22.1 Change Orders Initiated by Philip Morris. Philip Morris may at any time, by written notice, make changes in, additions to or deletions from the scope hereof. If any such change actually increases or decreases the time required for the performance of Contractor's obligations hereunder, an equitable adjustment shall be made in the Production Schedule. If any such change actually increases or decreases the cost to Contractor of performing the Work, then there shall be an equitable adjustment in the Contract Price.

Contractor's right to an equitable adjustment in the Contract Price or Production Schedule, or both, as a result of any change made by Philip Morris pursuant to this Section is expressly conditioned on Contractor providing Philip Morris written notice of a request for such adjustment within 10 days after Contractor receives Philip Morris' notice of change. Contractor's request for an equitable adjustment in the Contract Price or Production Schedule, or both, shall include a statement setting forth in detail, with a suitable breakdown by cost of material, equipment and services, Contractor's estimate of the change in its costs, if any, together with any proposed adjustment in the Contract Price or Production Schedule, or both. Philip Morris shall be liable for the costs actually incurred by Contractor in the preparation of estimates submitted in writing to and approved in advance by Philip Morris to the extent such costs exceed $20,000, provided that such costs shall be determined based on Contractor's labor at the rate of $60 per hour for engineering and $90 per hour for management.

Contractor shall proceed with its performance obligations as changed only after receiving a fully-executed change order setting forth an equitable adjustment in the Contract Price or Production Schedule, or both, as applicable. Contractor shall not halt or delay performance of any previously authorized Work pending resolution of a Philip Morris initiated change order.

Change orders initiated by Philip Morris shall be submitted using the format of Schedule K with attachment pages as may be required.

22.2 Change Orders Initiated by Contractor. Contractor may, at any time by written notice, propose a restatement of the Cash Flow Projection or the Production Schedule, or both. Upon receipt of such request, Philip Morris may require Contractor to provide written assurances reasonably acceptable to Philip Morris that such restatement shall not increase Contractor's cost of performing the Work or extend the time for Final Acceptance, or both, as the case may be. In the event Philip Morris accepts Contractor's proposal, the Cash Flow Projection or the Production Schedule, or both, as the case may be, shall be deemed to incorporate such restatement. Philip Morris may reject, in its sole discretion, any proposal for adjustment that may increase Contractor's cost of performing the Work or extend the time for Final Acceptance.

In addition, Contractor may, at any time, propose to Philip Morris, a change in the scope of Work hereof as a result of changes in the Applicable Standards subsequent to the date hereof or for other reasons. Contractor shall not halt or delay performance of any previously authorized Work pending resolution of a Contractor initiated change order.

22.3 **Effect of Change Orders.** Work performed pursuant to any change orders shall be subject to all applicable terms and conditions herein. Contractor shall not honor any oral request for a change in the scope of Work and shall not be entitled to an equitable adjustment in the Contract Price or Production Schedule, or both, for any work that is not authorized by a fully executed change order.

23. **Delays.** Neither Philip Morris nor Contractor shall be responsible or liable for, or deemed in breach hereof because of, any delay in the performance of their respective obligations hereunder due solely to circumstances beyond the reasonable control and without the fault or

negligence of the party experiencing such delay, including but not limited to acts of God, unusually severe weather, strikes or other labor difficulties, war, riots, requirements, legislative actions or failures to act on the part of governmental authorities preventing performance, inability despite due diligence to obtain required licenses, or fire (such causes hereinafter called "Force Majeure"); provided, however, the party experiencing the Force Majeure shall exercise due diligence in endeavoring to overcome any Force Majeure impediment to its performance, but settlement of its labor difficulties shall be entirely within its discretion. Delays caused by Contractor's subcontractors or suppliers are not events of Force Majeure, unless the subcontractor's or supplier's delay is due solely to an event of Force Majeure as defined above.

The party experiencing the Force Majeure shall promptly give written notification to the other party. This written notification shall give a full and complete explanation of the Force Majeure delay and its cause, the status of the Force Majeure, and the actions such party is taking and proposes to take to overcome the Force Majeure. If performance by either party is delayed due to Force Majeure, the time for that performance shall be extended for a period reasonably necessary to overcome the effect of the delay and the Production Schedule shall be deemed modified in accordance with such extension, if any. Contractor may notify Philip Morris of extraordinary measures that are available to overcome the effect of delay that would require a change order pursuant to Section 22.1. Notwithstanding the foregoing sentence, the party experiencing the delay shall undertake reasonable measures to make up for the time lost through delay without additional compensation.

24. Suspension. Upon written notice from Philip Morris, Contractor shall suspend the Work as provided therein for such time as Philip Morris may direct. Upon receipt of Philip Morris' suspension notice, Contractor shall not place further orders or enter into further subcontracts relating to the suspended work without Philip Morris' approval, which approval shall be in writing. Philip Morris shall not be liable for the cost of any unauthorized orders placed or subcontracts entered into by Contractor during any period of suspension. Upon receipt of Philip Morris' suspension notice, Contractor's personnel performing services hereunder and who are compensated on an hourly basis shall not perform services in furtherance of the Work more than eight hours per day, forty hours per week. If performance by Contractor is delayed due to the suspension, the time for that performance shall be extended for a period reasonably necessary to overcome the effect of the suspension and the Production Schedule shall be deemed modified in accordance with such extension, if any. If such suspension continues for 60 days, then Contractor may notify Philip Morris in writing that Philip Morris must either cease such suspension or be deemed to have terminated this Agreement pursuant to Section 25; in the event Philip Morris fails to give written notice of either cessation of such suspension or termination of this Agreement within 30 days of receipt of such notice from Contractor, this Agreement shall be deemed to be termination pursuant to Section 25 hereof.

25. Termination for Convenience.

25.1 Philip Morris may terminate this Agreement at any time, in whole or in part, by providing written notice of termination to Contractor, such termination to be effective as specified in the notice but not earlier than five business days after the notice is received by Contractor. At any time during the term of this Agreement and at Philip Morris' request and upon presentation by Philip Morris of a proposed plan for the disposition of the Work in progress, Contractor shall provide a written estimate of the reasonable costs of winding down the Work in accordance with Philip Morris' proposed plan.

25.2 If Contractor has performed its obligations under this Agreement as of the date of termination, as full and complete compensation for the Work, Philip Morris shall pay Contractor the actual cost of the Work payable pursuant to Section 11.1 through the effective date of termination plus (1) an allowance of 9.2% of the actual cost for Contractor's profit, (2) the actual cost of terminating any subcontracts that Philip Morris has not required be assigned to Philip Morris, (3) the actual costs for winding down of the Work reasonably incurred by Contractor and (4) severance pay for employees (a) identified in the Application for Payment submitted by Contractor immediately preceding receipt of notice of termination and (b) actually terminated by Contractor as a result of Philip Morris' termination of this Agreement, in an amount equal to three months salary for professional engineers and two months salary for other personnel (provided, however, that if such professional engineers and other personnel have been employed by Contractor for less than three or two months, respectively, such severance shall be limited to the number of months the individual was actually employed), less any payments made; provided, however, that in no event shall the total compensation paid exceed the Contract Price and provided further that Philip Morris shall have no liability for the costs of terminating any lease or labor agreements unless Philip Morris shall have had actual notice of the terms of such agreements prior to provision of its notice of termination.

25.3 Notwithstanding the foregoing Section 25.2, in the event Philip Morris terminates this Agreement upon the determination of the Manufacturing Expert as provided in Section 9.1, and if Contractor has performed its obligations under this Agreement as of the date of termination, as full and complete compensation for the Work, Philip Morris shall pay Contractor the actual cost of the Work payable pursuant to Section 11.1 through the effective date of termination.

25.4 Except as provided in Section 25.2 or Section 25.3, as the case may be, Philip Morris shall not be liable to Contractor for any unabsorbed overhead or unrealized profits respecting the Work. Contractor's Application for Payment for compensation in the event of ~~termination must be supported by sufficient records and documentation to enable Philip Morris~~ to verify all amounts claimed by Contractor. Upon termination pursuant to this paragraph, Philip Morris shall have no further obligation to Contractor respecting the Work, except for its obligations as described in this Section 25.

26. <u>Default by Contractor</u>

26.1 During the term of this Agreement, the occurrence of one or more of the following events shall be deemed a "Contractor Default":

26.1.1 Contractor shall fail to meet any Default Milestone set forth in the Production Schedule and Contractor shall fail to provide within five business days assurances reasonably acceptable to Philip Morris that, despite delays in the progress of the Work, Contractor will be able to meet the Final Delivery Date, subject to any extension of such date as provided in this Agreement, for any reason other than (a) delays caused solely by Philip Morris, where such delays are not the result of a breach by Contractor of its obligations hereunder, or (b) material breach by Philip Morris of its obligations hereunder; in the event Philip Morris fails to indicate in writing within five days of receipt of Contractor's assurances provided pursuant to this Section 26.1.1 whether it accepts or rejects Contractor's assurances, such assurances shall be deemed accepted;

26.1.2 Contractor shall fail to submit a restated ~~budget~~ cash flow projection pursuant to Section 11.1.2 or, upon submission of such restated ~~budget~~, Contractor shall fail, within five days, to provide assurance reasonably acceptable to Philip Morris that Contractor will be able to complete the Work for the Contract Price; in the event Philip Morris fails to indicate in writing within five days of receipt of Contractor's assurances provided pursuant to this Section 26.1.2 whether it accepts or rejects Contractor's assurances, such assurances shall be deemed accepted;

26.1.3 Contractor shall default in any material respect in obtaining and maintaining the insurance policies or bonds required pursuant to this Agreement;

26.1.4 Contractor shall default in the payment of any sum due and payable to Philip Morris hereunder and such default shall continue for 30 business days after receipt of written notice from Philip Morris that such payment is due and payable;

26.1.5 Contractor shall default in any material respect in the observance or performance of any other covenant, condition or obligation of Contractor contained herein, including: Contractor's failure to perform the Work in a skilled and expeditious manner with sufficient labor, materials, equipment and facilities; the failure of the Railcars to meet any warranty obligation; Contractor's failure or refusal to perform its obligations under Section 14.2; or Contractor shall make any material false or misleading statement in any certificate or document made or given pursuant to this Agreement; and if such default continues for 30 days after written notice to Contractor specifying the default and demanding that the same be remedied;

26.1.6 Contractor shall (a) file a petition commencing a voluntary bankruptcy or similar proceeding under any applicable bankruptcy or similar law, (b) be declared bankrupt or insolvent under any law relating to bankruptcy, or (c) admit in writing its inability to pay its debts as they become due; or

26.1.7 A custodian, receiver, trustee or liquidator shall be appointed in any proceeding brought against Contractor and shall not be discharged within 60 days after such appointment.

26.2 Upon the occurrence of any Contractor Default, Philip Morris may terminate this Agreement by written notice to Contractor and either (a) recover the payments made, less value received, for the Work or (b) take control of the Railcars, the Modified Locomotive(s) and Contractor's premises and facilities necessary to complete the Work and recover from Contractor an amount equal to the cost of completing the Work less the unpaid portion of the Contract Price, as a consequence of Contractor's Default and as damages, not as a penalty.

26.3 Contractor shall be liable for the costs and expenses incurred by Philip Morris by reason of the occurrence of any Contractor Default, or the exercise of Philip Morris' remedies with respect thereto, including all costs and expenses incurred in connection with the turnover of the Railcars and Modified Locomotive(s) to Philip Morris, the completion of the Work or any suit or action to enforce Philip Morris' rights and remedies.

26.4 Philip Morris' remedies set forth in this Section 26 shall not be exclusive, but shall be cumulative and may be exercised concurrently or consecutively, and shall be in addition to all other remedies Philip Morris may have under this Agreement or provided by law.

27. Effect of Philip Morris' Termination. Upon receipt of any termination notice from Philip Morris pursuant to Section 3.4, 25 or 26 hereof, Contractor shall:

27.1 stop performance of all Work hereunder, except as may be reasonably necessary to carry out such termination, protect Work in progress or as otherwise directed by Philip Morris;

27.2 issue no further purchase orders and enter into no further subcontracts relating to the Railcars, without the prior written consent of Philip Morris;

27.3 assign to Philip Morris, upon request and to the extent permitted by law, all rights of Contractor under contracts or purchase orders entered into by Contractor in connection with the Work;

27.4 to the extent permitted by law, upon Philip Morris' request, terminate existing contracts and purchase orders entered into by Contractor in connection with the Work;

27.5 ~~take any other action necessary or desirable to terminate the Work as Philip Morris~~ shall direct;

27.6 execute any documents reasonably necessary to permit Philip Morris full and free access to Contractor's facilities in order for Philip Morris or its designated representative (a) in the event of termination pursuant to Section 26, to complete the Work and (b) in the event pursuant to Section 25, to audit Contractor's expenses related to such termination and any Application for Payment.

27.7 turn over to Philip Morris all equipment and materials for the Railcars that are at Contractor's or its suppliers' shops and all drawings and specifications, whether partial or complete, relating to the Railcars then in the possession of Contractor or its subcontractors, vendors or suppliers.

28. Contractor's Additional Obligations. Contractor shall assure adequate capitalization until Final Acceptance by (1) not paying, whether by salary, dividend, distribution, bonus or otherwise, funds to any officer without Philip Morris' written consent , (2) not declaring or paying any dividend to Contractor's shareholders, (3) not making any payments (including loans) to any company that is affiliated with Contractor to satisfy debt or for any other purpose and (4) otherwise limiting the removal of monies from the corporation, except for auditable earnings on projects unrelated to the Work and monies for the repayment of loans made to Contractor during the term of this Agreement.

29. Philip Morris' Rights to Possession. In the event Contractor is the subject of any insolvency, bankruptcy, receivership, dissolution, reorganization or similar proceeding, federal or state, voluntary or involuntary, under any present or future law or act, Philip Morris shall, to the extent permitted by law, be entitled to the automatic and absolute lifting of any automatic stay as to the enforcement of its rights of possession pursuant to this Agreement, including but not limited to the stay imposed by § 362 of the United States Federal Bankruptcy Code, as amended. Contractor hereby consents to the immediate lifting of any such automatic stay and will not contest any motion by Philip Morris to lift such stay.

30. Default by Philip Morris.

30.1 During the term of this Agreement, the occurrence of one or more of the following events shall be deemed a "Philip Morris Default":

30.1.1 Philip Morris shall default in any material respect in the observance or performance of any other covenant, condition or obligation of Philip Morris contained herein, including any material false or misleading statements in any certificate or document made or given by Philip Morris pursuant to this Agreement; and if such default continues for 30 days after written notice to Philip Morris specifying the default and demanding that the same be remedied;

30.1.2 Philip Morris shall (a) file a petition commencing a voluntary bankruptcy or similar proceeding under any applicable bankruptcy or similar law, (b) be declared bankrupt or insolvent under any law relating to bankruptcy, or (c) admit in writing its inability to pay its debts as they become due; or

30.1.3 A custodian, receiver, trustee or liquidator shall be appointed in any proceeding brought against Philip Morris and shall not be discharged within 60 days after such appointment.

30.2 Upon the occurrence of any Philip Morris Default, Contractor may (a) terminate this Agreement by written notice to Philip Morris and (b) recover from Philip Morris any damages proximately caused by the Philip Morris Default, including the profit ratably earned prior to the Philip Morris Default.

30.3 Contractor's remedies set forth in this Section 30 shall not be exclusive, but shall be cumulative and may be exercised concurrently or consecutively, and shall be in addition to all other remedies Contractor may have under this Agreement or provided by law.

31. Consequential Damages. Except as noted below and notwithstanding anything to the contrary in this Agreement, neither Philip Morris nor Contractor shall be liable to the other for any incidental or consequential damages (even if such party has been advised of the possibility of such damages) including but not limited to, lost profits or savings, loss of use of services, cost of capital, or downtime costs.

Nothing in this Section shall be deemed to limit or exclude either party's liability in connection with or arising out of (1) any claim of a person or entity not a party to this Agreement or (2) any rights or obligations arising out of Sections 9.3, 21, 32.3 or 35.

32. Compliance with Laws; Nondiscrimination; Fines

32.1 General. Contractor shall comply with all United States (federal, state and local) laws, rules, regulations and ordinances applicable to Contractor's performance of its obligations under this Agreement, including but not limited to any laws or codes that are incorporated into the Specifications.

32.2 Nondiscrimination. Contractor agrees to comply with all applicable provisions of Executive Order 11246, as amended; § 503 of the Rehabilitation Act of 1973, as amended; § 402 of the Vietnam Era Veterans Readjustment Assistance Act of 1974, as amended; § 5152 of the Drug-Free Workplace Act of 1988; and implementing regulations set forth in 41 C.F.R. §§ 60-1, 60-250 and 60-741 and 48 C.F.R. §§ 23.5. Contractor agrees that it will comply with all applicable provisions of the Americans with Disabilities Act. Contractor agrees that the equal opportunity clause set forth in 41 C.F.R. § 60-1.4 and the affirmative action clauses set forth in 41 C.F.R. § 60-250.4 and 41 C.F.R. § 60-741.4 are hereby incorporated by reference and made a part of this Order. Contractor certifies that it does not and will not maintain any facilities it provides for its employees in a segregated manner and that it does not and will not permit its employees to perform their services at any location under Contractor's control where segregated facilities are maintained. Contractor further agrees to submit and obtain such certifications of nonsegregated facilities as are required by 41 C.F.R. § 60-1.8. The provisions of this paragraph shall apply to Contractor only to the extent that (1) such provisions are required of Contractor under existing law, (2) Contractor is not otherwise exempt from said provisions and (3) compliance with said provisions is consistent with and not violative of 42 U.S.C. § 2000e et seq., 42 U.S.C. § 1981 et seq., or other acts of Congress.

32.3 Fines. Any fines or other penalties incurred by Contractor or its agents, employees or subcontractors for noncompliance with any laws, rules, regulations or ordinances with which compliance is required herein shall not be reimbursed by Philip Morris, but shall be the sole responsibility of Contractor. If fines, penalties or legal costs are assessed against Philip Morris by any government authority or court due to noncompliance by Contractor with any of the laws, rules, regulations or ordinances with which compliance is required herein, or if the work or any part thereof is delayed or stopped by order of any government authority or court due to Contractor's noncompliance, Contractor shall indemnify and hold harmless Philip Morris against any and all losses, liabilities, damages, claims and costs (including reasonable attorneys' fees) suffered or incurred because of the failure of Contractor to comply therewith.

33. Licenses, Permits and Approvals. Contractor shall obtain and pay for all governmental licenses, permits and approvals necessary for the manufacture of the Trainset and each component thereof under this Agreement and, except as provided in Section 3.4, such permits, licenses, certificates and approvals as may be required to demonstrate that the Railcars satisfy all requirements imposed by applicable law for railcars operating in the United States. To the extent that inspections are required by any governmental agency, Contractor shall arrange for and make its facilities and the Railcars available for such inspections.

34. Inspections. Philip Morris shall have reasonable access to Contractor's manufacturing, design and other facilities, as well as the facilities of Contractor's subcontractors and suppliers, for the purpose of (a) auditing compliance with Contractor's quality control and assurance programs, (b) inspecting the material, equipment and services covered by this Agreement and (c) expediting the Work. Such inspections shall not relieve Contractor of its obligation to provide material, equipment and services that comply in all respects with the requirements hereof. Philip Morris shall also be entitled to review all quality control and assurance records, to inspect materials and equipment during manufacture and to witness all tests. Subcontracts placed for material, equipment and services shall include a provision granting Philip Morris similar access to subcontractors' facilities.

35. Confidentiality and Confidential Information. This Agreement and the terms and conditions herein are considered confidential. The parties have entered into two separate confidentiality agreements both dated October 13, 1994, the terms of which are incorporated herein by reference.

36. Ownership of Materials, Drawings and Data. All drawings, blueprints, photographs, sketches, software, electronic records and other materials (collectively, "Design Materials") prepared for Contractor or furnished to Contractor in the course of Contractor's work hereunder shall belong to Philip Morris and shall not be used for or revealed, divulged or made known to any person, firm or corporation (other than Contractor's subcontractors and suppliers to the extent required to perform this Agreement) without the prior written consent of Philip Morris. Upon Philip Morris' request, Contractor shall provide Philip Morris with all such materials, together with any reproductions of such materials which Contractor or its subcontractors and

suppliers may have made, provided that Contractor may retain one copy of such materials for record purposes.

All Design Materials including but not limited to Specifications, Contract Drawings and Shop Drawings, prepared by Contractor in connection with this Agreement shall belong to Contractor; provided, however, Contractor may not use the Design Materials (a) for use on any work delivered on or before October 31, 1998 to persons or entities engaged in the marketing, manufacture or distribution of consumer products or consumer services (other than travel services) and (b) for use on any work delivered on or before the expiration of the ten-year period commencing upon Final Acceptance to persons or entities engaged in the marketing, manufacture or distribution of tobacco products. Contractor shall furnish Philip Morris with full sized, hard copy reproductions of Contractor's Design Materials, which reproductions shall be the property of Philip Morris. Upon Final Acceptance or any early termination of this Agreement pursuant to Section 26, Philip Morris may use the reproductions for any purpose relating to the Trainset, including, but not limited to, completion of the Work by Philip Morris or its contractors.

37. Records; Audits. Contractor shall keep and maintain complete and accurate records, books of account, reports, third party inspection reports and other data necessary for the proper administration of this Agreement for five years after the completion or termination of this Agreement and for any additional time required by governmental authorities with jurisdiction over Contractor. Contractor shall keep and maintain a complete and accurate set of all written materials, technical information, design calculations and drawings prepared by Contractor or provided by Philip Morris for five years after the completion or termination of this Agreement. Thereafter, Contractor shall notify Philip Morris at least 60 days prior to disposal of any such materials, and if Philip Morris so requests, Contractor shall deliver to Philip Morris any such materials.

Philip Morris shall have the right, upon reasonable notice to Contractor, during the performance hereof and for two years following the completion or termination hereof, to have Philip Morris' auditor audit and inspect Contractor's books and records pertaining to the computation of cost-based equitable adjustments and termination costs payable to Contractor hereunder. If the audit and inspection reveals an error or irregularity in the computation of equitable adjustments or termination costs, an appropriate adjustment shall be made within 30 days after identification of the error or irregularity. Philip Morris shall pay for any audit and ~~inspection~~; ~~provided, Contractor shall pay all~~ expenses ~~incurred~~ by ~~Contractor~~ in ~~supporting~~ ~~the~~ audit and inspection.

38. Technical Arbiter. In the event the Technical Arbiter is no longer willing or able to provide resolution of technical disputes hereunder, the parties shall promptly select another Technical Arbiter. The parties shall share equally the costs associated with obtaining resolution by the Technical Arbiter. In the event the parties are unable to select a replacement Technical Arbiter within 10 business days after the existing Technical Arbiter ceases to act, both parties shall mutually request that a Technical Arbiter be selected and appointed for them by a mutually-acceptable arbitration or mediation group.

39. <u>Dispute Resolution</u>

39.1 <u>Intent</u>. It is the intention of the parties to make a good faith effort to resolve, without resort to litigation, any Dispute according to the procedures set forth in this Section.

39.2 <u>Procedure</u>. Contractor's and Philip Morris' designated representatives shall attempt to resolve all Disputes by negotiation. In the event a Dispute cannot be resolved promptly by Contractor's and Philip Morris' representatives, each party shall immediately designate a senior executive with authority to resolve the Dispute. The designated senior executives shall promptly begin discussions in an effort to agree upon a resolution of the Dispute. If the senior executives do not agree upon a resolution of the Dispute within 20 days of the referral to them, either party may elect to abandon negotiations. If a Dispute cannot be resolved pursuant to the procedures outlined in this paragraph, the parties may pursue any remedy available to them at law or in equity.

40. <u>Notices</u>. Except as provided in Section 4, all certificates or notices required hereunder shall be given in writing and addressed or delivered to the representative(s) specified in this Agreement. Copies of all general correspondence regarding this Agreement shall also be sent to these representatives. Any notice or communication required hereunder shall be given by hand; courier service; registered, certified, express or first class mail (postage prepaid), TWX, telex or telecopy. The date of receipt of any notice sent by mail (except for confirmatory notices) shall be the date the notice shall be deemed to have been given.

Notices required hereunder shall be directed to the following individuals:

Notices to Contractor:

Mr. Thomas Rader
Rader Railcar, Inc.
10700 E. 40th Avenue
Denver, Colorado 80239

Notices to Philip Morris:

~~Category Director, Marlboro~~
Philip Morris Incorporated
120 Park Avenue
New York, New York 10017

with a copy to

Assistant General Counsel
Philip Morris Management Corporation
120 Park Avenue
New York, New York 10017

Either party may change the representative(s) designated to receive notice hereunder by written notice to the other party.

41. General

41.1 Governing Law. The statutes and judicial interpretations of the State of New York shall govern the validity and construction of this Agreement without out regard to choice of law provisions.

41.2 Nonwaiver. The failure of either party to demand strict performance of the terms hereof or to exercise any right conferred hereby shall not be construed as a waiver or relinquishment of its right to assert or rely on any such term or right in the future.

41.3 Severability. The remainder hereof shall not be voided or otherwise affected by the invalidity of one or more of the terms herein.

41.4 Assignment and Subcontracting. Except as permitted pursuant to this Agreement, Contractor shall not assign, subcontract or otherwise delegate any of its rights or obligations hereunder without Philip Morris' prior written consent.

41.5 Survival. All warranties, indemnities, intellectual property and confidentiality rights and obligations provided herein shall survive the termination, completion or cancellation hereof.

41.6 Amendments. No amendment, modification or waiver of any term hereof shall be effective unless set forth in a writing signed by Philip Morris and Contractor.

~~41.7 Independent Contractor. Contractor is an independent contractor for all purposes~~ hereof. The contract evidenced by this Agreement is not intended to be one of hiring under the provisions of any workers' compensation or other laws and shall not be so construed.

41.8 Headings. Headings contained herein are inserted for convenience and shall have no effect on the interpretation or construction hereof.

41.9 Publicity. Each party agrees that no information relative to this Agreement shall be released for publication, advertising or any other purpose without the other party's prior written consent.

41.10 Counterparts. This Agreement may be executed in any number of counterparts, each of which shall be deemed an original, but all of which when taken together shall constitute one and the same document.

41.11 Negotiated Agreement. This Agreement and the Contract Documents represent the negotiated agreements of both parties and shall not be construed against the drafting party.

41.12 Entire Agreement. This Agreement constitutes the entire agreement of the parties with respect to the subject matter herein and supersedes any prior or contemporaneous agreement or understanding between the parties. No course of dealing, no usage of trade and no course of performance shall be used to supplement or explain any term, condition or instruction herein, nor be deemed to effect any amendment.

[SIGNATURES APPEAR ON THE FOLLOWING PAGE]

WITNESS the following signatures:

PHILIP MORRIS INCORPORATED	RADER RAILCAR, INC.
By ____________	By ____________
Title ____________	Title President
Date ____________	Date 12/31/94

SPECIFICATIONS
FOR A TRAINSET
CONSISTING OF
TWO (2) LOCOMOTIVES
AND EIGHTEEN (18) RAIL CARS

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SCOPE, RESPONSIBILITIES INSPECTIONS
SECTION 1

1.1 SCOPE AND PURPOSE

1.1.1 General

These technical Specifications (the Specifications) describe the construction and operating criteria for the provision of one (1) Trainset consisting of two (2) PM supplied Locomotives (the Locomotives) and eighteen (18) specially outfitted railcars (each a "Railcar" or collectively the "Railcars").

Contract Drawing LTNG 00 is a schematic of the Trainset that shows the designation and location of Locomotives and Railcars.

The Railcars and the Locomotive modifications shall comply in all respects with the requirements of the applicable laws of the United States of America. They shall also comply with the applicable requirements of the following agencies and legislation:

- U.S. Department of Transportation (USDOT)
- Federal Railroad Administration (FRA)
- Federal Transit Administration (FTA)
- Americans with Disabilities Act of 1990 (ADA)
- United States Public Health Service (USPHS)

The Railcars and the Locomotive modifications shall comply with the applicable standards and recommended practices of the Association of American Railroads (AAR). Current versions of AAR requirements shall be utilized, with the exception of requirements unique to passenger rolling stock, which shall be governed by AAR's "Manual of Standards and Recommended Practices - Section A, Part III-Passenger Car Requirements (Issue of 1980, Revised 1984)".

The Trainset shall be made accessible to handicapped passengers in accordance with current ADA requirements to the extent modified herein. Each Railcar and Locomotive is not ADA accessible per se. The Contract Drawings show where ADA facilities are provided. There are two (2) cabins, built to ADA requirements as shown on Contract Drawing LTNG 04. The Dining Car, three (3) Lounge Cars, and passenger toilets are designed to ADA requirements. The Spa Car design does not provide for handicapped passengers due to the impact on capacity and functioning of the Spa Car. The Locomotives, Power Car and Staff Cars do not conform to ADA requirements

1.1.2 Locomotive and Railcar Definitions and Numbers

Section	Page

The following Locomotive and Railcar definitions and numbers provide an overview of each Railcar type. Additional details are provided in the appropriate sections of these Specifications.

Car No.	Type	Definition
1&2	Locomotive	Locomotives shall be supplied by PM. These Specifications provide only for the Contractor to effect modifications to the Locomotive's appearance by the installation of a fiberglass shell intended to provide a streamlined appearance. No other work is provided for the Locomotives. Details of the Contractor responsible work on the PM Locomotives are contained in Section 12.
3	Power	An existing baggage car shall be remanufactured to include two(2) installed generator sets together with the appropriate control and distribution systems that shall be capable of producing sufficient electrical power to permit the Trainset to operate at least eighty-five percent (85%) of its installed electrical load with only one generator set in operation. This Power Car shall also have provisions for a separate maintenance area and a separate baggage storage area. Details of the Power Car are contained in Section 13. The Railcar was formerly Northern Pacific Railcar NP433 on tracks at Contractor.
4&5	Staff/22	Two (2) existing single level sleeper cars shall be refurbished to provide accommodations for 22 staff in single or double occupancy roomettes per car. The roomettes shall have private closet and drawer space with locks and under seat storage for bags and multiple-cabin use toilet facilities.

Car No.	Type	Definition
		These Staff/22 cars shall be procured by the Contractor and specifically identified to PM. Details of the Staff/22 cars are contained in Section 14.
6	Staff/8	An existing single level sleeper shall be refurbished to provide at least eight (8) single-occupancy roomettes with private closet and drawer space with locks and under seat storage for bags and multiple-cabin use toilet facilities. In addition, a dining area for the staff shall be provided with seating for at least twenty (20) staff simultaneously. Details of the Staff/8 car are contained in Section 14. The Staff/8 car shall be procured by the Contractor and specifically identified to PM.
7-14	Sleeper	Each of eight (8) passenger rail cars shall be remanufactured to provide fifteen (15) double-occupancy cabins each with private toilets and showers, and drawer and closet space adequate for a five day stay. With the exception of #14 Railcar, there shall be thirteen (13) standard, one (1) deluxe and one (1) superior category stateroom in each Sleeper. Railcar #14 shall have two (2) ADA staterooms in lieu of two (2) standard category staterooms. Each Sleeper Railcar shall be bi-level with glass dome windows the full length of the upper level. The details of the cabin interiors, which includes outfitting, furnishings, electrical outlets TV/VCR hookups and amenities commensurate with luxury travel are contained in Section 15. Contract Drawings LTNG 01 through LTNG 05 are the general arrangements and other drawings applicable to these Sleeper Cars; the

Car No.	Type	Definition
		Standard and Deluxe Staterooms and the ADA Staterooms.

The following cars have been procured and shall be remanufactured by the Contractor into Sleeper Cars, Lounge Cars or Spa Car, as determined by the Contractor, to comply with the requirements of the Agreement:

Car #	Location as of 11/27/94	Builder	Year
SP 3709	On tracks at Contractor	Pullman Std	1955
SP 3710	On tracks at Contractor	ACF	1957
SP 3711	Leased to DTP	ACF	1957
SP 3716	Leased to DTP	ACF	1957
SP 3725	Leased to DTP	ACF	1957
SP 3726	On tracks at Contractor	ACF	1957
SP 3731	Leased to DTP	Pullman Std	1969
SP 3732	Leased to DTP	Pullman Std	1969
SP 3733	Leased to DTP	Pullman Std	1969
SP 3735	Shelled at Contractor	Pullman Std	1969
SP 3736	Shelled at Contractor	Pullman Std	1969
SP 3737	Leased to DTP	Pullman Std	1969
SP 3739	Shelled at Contractor	Pullman Std	1969
SOO 624	On back lot at Contractor	CMS&P RR	1948

15 Dining with Kitchen

One (1) passenger railcar shall be remanufactured to a bi-level railcar with a car-length dome and dining room with service area on the upper level.

The combined dining room seating capacity of the two (2) dining cars provided in these Specifications shall be capable of serving all passengers in two (2) seatings.

A galley capable of preparing fresh foods for three meals per day and a passenger passageway are located on the lower level. Galley storage shall be adequate for staples and the majority of perishables.

Details of the Dining Car with Kitchen interiors, including outfitting, furnishings, equipment, etc. are contained in Section 16.1.

Contract Drawings LTNG 06 is a general arrangement of this Dining Car.

Car No.	Type	Definition
16	Dining without Kitchen	One (1) passenger railcar shall be remanufactured to a bi-level railcar with a car-length dome and dining room on the upper level. A library, PM office and kitchen service area, ADA lavatory, passenger passageway, and a staircase to the upper level shall be located on the lower level. PM is to supply all office equipment to Contractor for installation. Details of the Dining Car without Kitchen interiors, including outfitting furnishings, equipment, etc. are contained in Section 16.2. Contract Drawing LTNG 07 is a general arrangement of this Dining Car.
17	Lounge 1	One (1) passenger railcar shall be remanufactured to a bi-level railcar with a car-length dome and observation lounge with a seating capacity (including bar) of sixty (60) passengers in a living room type configuration on the upper level. On the lower level a general store, lounge with bar area, ADA lavatory and ADA lift and a staircase to the upper level are provided. Details of Lounge Car 1 are contained in Section 17.1. Contract Drawing LTNG 08 is a general arrangement of Lounge Car #1.
18	Lounge 2	One (1) passenger railcar shall be remanufactured to a bi-level railcar with a car-length dome and observation lounge with a seating capacity of sixty (60) passengers (including bar) in a living room type configuration on the upper level. Provided on the lower level are a virtual-reality game room, a multi-media room, an

Car No.	Type	Definition
		open-air platform, an ADA lavatory, and a staircase to the upper level.
		PM shall supply all electronic games for this Lounge Car #2 for installation by the Contractor.
		Details of Lounge Car #2 are contained in Section 17.2.
		Contract Drawing LTNG 09 is a general arrangement of Lounge Car #2.
19	Lounge 3	One (1) existing passenger railcar shall be remanufactured to a bi-level railcar with a car-length dome, two (2) lounge areas, and a Disco area with dance floor and a bar on the upper level.
		The lower level shall consist of a Saloon area with bar, a dance floor and stage, card playing and pinball machine areas. Two (2) lavatories, one of which is ADA compliant,and a staircase to the upper level are also provided.
		PM shall supply all electronic games and pinball machines for this Lounge Car #3 for installation by the Contractor.
		Details of Lounge Car #3 are contained in Section 17.3.
		Contract Drawing LTNG 10 is a general arrangement of Lounge Car #3.
20	Spa	One (1) passenger railcar shall be remanufactured to a single level Spa Car with up to six (6) hot tubs with a total capacity for 18-30 passengers, two (2) to four (4) private massage rooms, and separate male and female changing rooms with showers and lavatory.
		Details of the Spa Car are contained in Section 18.
		One end of this Spa Car shall have an open-air observation platform.

1.1.3 Equal or Equivalent

Whenever the word "equal" or "equivalent" is used in connection with a specific manufacturer or item of equipment in the Specifications, it means that in order to substitute any other component for use in lieu of the specified component, the proposed substitute brand or make of material, device or equipment must be determined by the Contractor to be equal to that specified, taking into account the appropriate following factors:

- Safety
- Quality
- Workmanship
- Economy of operation
- Reliability
- Maintainability
- Interchangeability
- Suitability for the purpose intended

In the event the Contractor elects to use any supplier, design, or device other than those specified herein, the Contractor shall consider whether the "equal" has service-proven on transit and/or railroad systems in the same functional application as intended for these cars. The Contractor shall advise PM on each occasion Contractor employs any "equal" or "equivalent" component brand, make of material, device or equipment.

1.1.4 Definitions, Abbreviations and Standards

Wherever the following terms are used in the Specifications, the intent and meaning shall be interpreted as follows:

<u>Adhesion, Coefficient of</u> - During rolling contact, the ratio between the longitudinal tangential force at the wheel-rail interface and normal force.

<u>Agreement</u> - The agreement signed by PM and the Contractor of which these Specifications are therein referred to as Schedule B.

<u>Approval</u> - A determination by the Engineer given to the Contractor in writing that one or more elements of Contractor's responsible work conforms to the requirements of the Agreement and the Specifications.

<u>Approved or Approved Type</u> - Design, type of material, procedure, or method given Approval by PM.

<u>Availability</u> - The percentage of the Railcar fleet useable for normal service at the beginning of each day's schedule.

Baseline Design - The design of the Trainset or any of its components, apparatus, systems, subsystems, or materials which are reflected in the Agreement on the date of signing the Agreement.

Baseline Work - Contractor responsible work as defined in the Agreement on the date of signing the Agreement.

Burn-In - A trouble-free, operational test conducted by Contractor after all other tests are successfully completed.

Calculations - Numerical computations performed to demonstrate compliance with the Specifications.

Car History Book - A document recording technical and parts data pertinent to an individual car.

Certificate of Conformance - A certification by a supplier, manufacturer or sub contractor that provides information necessary to confirm that the item(s) being provided the Certificate of Conformance comply with the requirements of the Specifications.

Coast - The mode of operation of a Railcar or train in which propulsion (positive traction) and brake (negative traction) are inactive and the apparent braking effort results only from the train's rolling resistance and aerodynamic drag.

Commissioning - Pre-acceptance Contractor activities involved in delivering, adjusting, and testing the cars to demonstrate compliance with Specifications requirements.

Comment - Written critiques of the Contractor's submittals to PM.

Contract Documents - The Agreement and Schedules incorporated therein.

Contract Drawings - Drawings provided by Contractor as part of the Contract Documents and referenced to in the Agreement as Schedule C, Plans and Drawings.

Contractor's Drawings - Items such as general arrangement drawings, detail drawings, graphs, diagrams, and sketches which are prepared by the Contractor.

Delivery - The transfer of the Provisionally Accepted Railcars or Trainset (with all in-plant testing completed and results accepted by PM) to the custody of PM.

Design Speed - The anticipated maximum operating speed of the Trainset. The Design Speed is 85mph. The Trainset and its components shall be suitable for safe operation at this speed.

Downtime - See Time, Down.

Equal - See Section 1.1.3

Equivalent - See Section 1.1.3

Engineer - The person or firm designated by PM in the Agreement as its sole representative at the Contractor's facility(ies).

Extra Work - Work that is not part of the Contractor responsible work as defined in the Agreement as of the date of signing of the Agreement. Extra Work requires a Change Order agreed to in writing in accordance with the provisions of the Agreement prior to the commencement of the Extra Work.

Fail-Safe - A characteristic of a system which insures that any malfunction affecting safety will cause the system to revert to a safe state.

Failure - An event which will cause a delay in normal service or require a railcar to be withheld from or removed from normal service for corrective action.

Failure Rate - The frequency of failure, expressed as failures per hour or failures per mile. Failure rate is the mathematical reciprocal of MTBF or MDBF.

Final Acceptance - The act of PM accepting delivery of the Trainset in accordance with the provisions of the Agreement.

First Article - The first unit of any production component of a Railcar that is produced in accordance with approved drawings.

First Article Inspection (FAI) - An extraordinary inspection of a First Article which accomplishes three (3) purposes:

- Observation in three (3) dimensions by the Engineer, to see what could be easily seen only on two-dimensional drawings to that point. If the First Article Inspection is of a component that the Contractor is purchasing, rather than manufacturing, the First Article Inspection discloses details that were not previously visible.

- When a First Article Inspection takes place, the Engineer shall either (a) confirm conformance of the design to these Specifications, or (b) provide the specific reasons for his not confirming such Specifications conformance promptly in writing to the Contractor. The Contractor shall take appropriate action to ensure First Article Inspection conformance with the Specifications.

- To establish the level of the quality of workmanship that will be maintained for the balance of the components.

First Sleeper Car - The first sleeper car which undergoes the remanufacturing and modification process and, once approved, serves as the standard to be met by the balance of the sleeper cars.

Independent Failure - A failure which is not the result of another failure, either directly or indirectly.

Interface - The points at which two or more systems, subsystems or structures meet, transfer energy, or transfer information.

Jerk Rate - Time rate of change of acceleration and deceleration, equal to the second time derivative of velocity.

Jumper - A short piece of wire or cable with appropriate terminations on each end to permit connection to terminals within a terminal board or to an adjacent terminal strip.

Lowest Level Replaceable Unit (LLRU) - A unit (component) or subsystem which can be replaced at an equipment maintenance facility.

Maintainability - The ability of a vehicle to be maintained including enhancement of access to equipment and components that require maintenance.

Mean Distance Between Failures (MDBF) - The mean operating mileage between independent failures.

Mean Time Between Failures (MTBF) - The mean operating time between independent failures.

Propulsion System - The system of wheels, engines, transmissions, direct controls and appurtenances that propels the Locomotive(s) in response to control signals.

Provisional Acceptance - The acceptance by PM's Engineer of Railcar(s) on a provisional basis after the demonstration of conformance in all respects of such Railcar(s) to the Specifications.

Recondition - See "Remanufacture".

Refurbish - See "Remanufacture".

Reliability - The probability of performing a specified function without failure for the period of time under actual operating conditions.

Remanufacture - To disassemble, clean; inspect; repair, replace or renew per Specifications requirements; and reassemble equipment to achieve the same level of utility, service life, and function as "new" equipment.

Renew - To provide an identical item of material in new (i.e., unused) condition.

Replace - To provide an identical item of material in new or remanufactured condition.

Service Speed - The anticipated maximum normal operating speed of the Trainset is 79 mph. The Trainset and its components shall be suitable for safe operation at this speed.

Shop Drawings - Drawings or sketches prepared by the Contractor for use in its remanufacturing or other activities.

Slide, Wheel - The condition existing during braking when the rotational speed of the wheel is less than that for pure rolling contact between wheel tread and rail.

Slip, Wheel - The condition existing during acceleration when the rotational speed of the wheel is greater than that for pure rolling contact between wheel tread and rail.

Specifications - Schedule B of the Agreement which describes the technical requirements of the Agreement.

Specifications Deliverable List (SDL) - List of items to be provided by the Contractor to PM as defined in the Specifications.

Speed, Balancing - The steady-state speed attained by a Railcar or consist when resisting forces exactly equal the maximum available tractive forces on level tangent track.

Stop, Emergency - The stopping of a vehicle or train by an emergency brake application.

Stop, Service - The stopping of a vehicle or train by application of service braking.

Tamperproof - Designation for fasteners selected so that they can not be easily loosened with common tools.

Tight (used as a suffix) - Designation indicating that when apparatus is "watertight", "dusttight", etc., it has been constructed so that the enclosing case will exclude the specified material.

Time, Down - The elapsed time during which equipment is not capable of doing useful work.

Time, Warmup - The elapsed time from application of power to an operable device until it is capable of performing its intended functions.

Vital Circuit - Any circuit and its elements, the function of which affects the safety of vehicle or train operations or both.

Warp Track - The vertical distance between the plane of any three of four rail head contact points (two on each rail) forming a plane and the remaining point.

Weight, Actual - The measured weight of a finished empty Railcar ready for normal service including normal levels of liquids and supplies but without passengers.

1.1.5 Abbreviations

The following is a list of abbreviations used in the Specifications. The list is provided as information and is not intended to be all inclusive nor are all abbreviations necessarily used herein.

AAR	Association of American Railroads
AATCC	American Association of Textile Chemists and Colorists
AC	Alternating Current
AFBMA	Anti-Friction Bearing Manufacturer's Association
AFI	Air Filter Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Moving & Conditioning Association
AMP	Amperes
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
APS	Auxiliary AC Power Supply
APTA	American Public Transit Association
AREA	American Railway Engineering Association
ARI	Air Conditioning and Refrigeration institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASM	American Society for Metals
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
AWS	American Welding Society
BHP	Brake Horsepower
Btu	British Thermal Unit
CAD	Computer Aided Design
cfm	Cubic Feet Per Minute

CFR	Code of Federal Regulations
dB	Decibel
dBA	Decibel, A-Weighted Scale
DC	Direct Current
D_s	Specific Optical Density
DTMF	Dual-Tone Multi-Frequency
E	Modulus of Elasticity
ECR	Engineering Change Request
ECU	Electronic Control Unit
EER	Energy Efficiency Ratio
EIA	Electronic Industries Association
EMC	Electromagnetic Control
EMF	Equipment Maintenance Facility
EMI	Electromagnetic Interference
°F	Degrees Fahrenheit
°FDB	Degrees Fahrenheit Dry Bulb
°FWB	Degrees Fahrenheit Wet Bulb
FAI	First Article Inspection
FCC	Federal Communications Commission
FEA	Finite Element Analysis
FMEA	Failure Mode and Effects Analysis
FTA	Federal Transit Administration
fpm	Feet Per Minute
FRA	Federal Railroad Administration
FRP	Fiberglass Reinforced Plastic
g	Gravitational Acceleration
GP	General Purpose
GTO	Gate Turn-Off
HAZ	Heat Affected Zone
HEP	Head End Power
HCFC	Hydrochlorofluorocarbon
BFC	Hydrofluorocarbon
BP	Horsepower
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
IC	Integrated Circuit
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IEPC	Institute of Printed Circuits
IPER	In-Process Engineering Review
IPS	Iron Pipe Size
ISO	International Standards Organization Flame Spread Index
Is	Flame Speed Index
JEDEC	Joint Electronic Device Engineering Council
kHz	Kilohertz
kw	Kilowatt
LAHT	Low Alloy High Tensile strength (steel)
lb	Pounds
lbf	Pounds force
LED	Light Emitting Diode

LLRU	Lowest Level Replaceable Unit
LVDB	Low Voltage Distribution Bus
LVDN	Low Voltage Distribution Network
LVPS	Low Voltage dc Power Supply
MC	Master Controller
MDBF	Mean Distance Between Failure
MHz	Megahertz
MIL	Military Specifications
mph	Miles Per Hour
mphps	Miles Per Hour Per Second
mphpsps	Miles Per Hour Per Second Per Second
ms	Millisecond
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
Mv	Multiple-Unit
μA	Micro Ampere
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturers" Association
NFL	No Field Lubrication
NFPA	National Fire Protection Association
NTP	Notice to Proceed
OD	Outside Diameter
OEM	Original Equipment Manufacturer
OHDS	Overhead Heat Duct Sensor
OSHA	Occupational Safety and Health Administration
PA	Public Address
PCU	Pneumatic Control Unit
PIV	Peak Inverse Voltage
ppm	Parts Per Million
PS	Pressure Switch
psi	Pounds Per Square Inch
psia	Pounds Per Square Inch, Absolute
psig	Pounds Per Square Inch, Gauge
PTE	Portable Test Equipment
PTFE	Polytetrfluoroethylene
QA	Quality Assurance
R-22	Refrigerant 22
R-C	Resistive-Capacitive
RFI	Radio Frequency Interference
RH	Relative Humidity
rms	Root Mean Square
rpm	Revolutions Per Minute
SAE	Society of Automotive Engineers
scfm	Standard Cubic Feet Per Minute
SIC	Standard Industrial Code (U.S. Department of Labor)
SPL	Sound Pressure Level
S/N	Signal to Noise Ratio
T_a	Ambient Temperature
Ti	Interior Temperature
TFE	Tetrafluoroethylene

TIG	Tungsten Inert Gas
TSDL	Technical Specifications Deliverable List
TOR	Top-of-Rail
TXV	Thermal Expansion Valve
UL	Underwriters Laboratories Inc.
UNC	Unified National Coarse (Thread)
UNF	Unified National Fine (Thread)
US	United States
USASI	United States of America Standards Institute
USDOT	United States Department of Transportation
USPHS	United States Public Health Service
UV	Ultraviolet
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
VMU	Vehicle Monitoring Unit
VOM	Volt/Ohm Meter
VPI	Vacuum Pressure Impregnation
VSWR	Voltage Standing Wave Ratio
W	Watt
WPS	Weld Procedure Specifications

1.2 RESPONSIBILITIES OF THE CONTRACTOR

1.2.1 General

The Contractor shall supply all labor, tools, materials, parts, and apparatus required for completing the Railcars and modifications to the Locomotives, except as indicated in the Specifications as being supplied by PM. The cars shall be remanufactured and upgraded to a level of performance, safety, quality of materials, workmanship, and reliability sufficient to provide a minimum Railcar service life of 15 years.

The Contractor shall perform all necessary design work required for the Railcars and Locomotives to meet the requirements of these Specifications, and shall prepare detailed drawings, design calculations and other specified technical documentation as appropriate. Wherever in the Specifications parameters or requirements are listed, they represent minimum, not absolute values. It shall be the Contractor's responsibility to meet all performance requirements except as specifically exempted.

1.2.2 Correspondence Control

The Contractor shall maintain appropriate procedures for correspondence administration and control to ensure orderly project communications. As part of this effort, all correspondence including letters, memoranda, reports and other correspondence shall be marked to indicate sender, receiver, and subject type, together with a short description of subject matter.

1.2.3 Quality Assurance

The Contractor shall establish and maintain a quality assurance program as described in Section 3. The program shall provide compliance with the Contract Documents.

1.2.4 Drawings

The Contractor shall develop and provide detailed design drawings for the Railcars and Locomotives as may be required by the Contractor in the performance of the Contractor's work. Views may include cross sections, floor plan, side view and underfloor. Drawings of overhauled and existing structure, systems and components are not required. Sketches and marked-up drawings may be used during First Sleeper car, other first type Railcars and mock-up construction.

1.2.5 Mock-Up and the First Sleeper Car

The Contractor shall construct a full-scale mock-up of a section of a sleeper car that shall include at least one cabin on the upper level and one cabin on the lower level simultaneously. This mock-up shall be used to perform First Article Inspection and to facilitate the design and construction process of the First Sleeper Car.

The Contractor shall arrange its work so one sleeper car shall precede the others in all stages of work. This Railcar shall be designated the First Sleeper Car and shall serve as the prototype for the remaining sleeper cars. The Engineer shall Approve the First Sleeper Car and its components. Modifications and other elements of work on the remaining cars may be made by the Contractor after Approval has been give by the Engineer for such individual work elements on the First Sleeper car. This procedure shall be continued until the First Sleeper Car is completed. All other cars shall be completed in accordance with the First Sleeper Car. No changes shall be made unless authorized in writing pursuant to the changes provisions of the Agreement.

1.2.6 Serial Numbers

The Contractor shall furnish PM a record of all serial numbers of trucks, wheels, axles, engines, HVAC units, and all other major components on all cars as delivered with any new material properly identified as such. This information (where existing) shall be included in the Car History Book.

1.2.7 Notification of Inspections and Testing

The Contractor shall perform or have performed all tests listed in Section 4 except as relieved by the obtaining of appropriate certifications of compliance. The Contractor:

- Shall provide copies of all test procedures to the Engineer at least ten (10) days prior to performance of tests.
- Shall notify Engineer of the date arranged for such inspection and testing no less than five working days in advance so that PM may be present to observe same, should PM deem it necessary to do so.
- If the Engineer does not attend such inspections or testing, having been given the above notifications, such lack of attendance shall be deemed to be acceptance of the testing results and a waiver of the Engineer's presence at such inspections or tests.
- Shall provide copies of all test data, results and conclusions.

All certificates of inspection, testing and approval required by PM or public authorities shall be secured by the Contractor and promptly delivered to PM.

1.2.8 Interior Material Samples

The Contractor shall provide samples of plastics, upholstery material, paint chips, floor coverings and similar items proposed for use in the Railcars' interiors as part of the review process.

A decorative material schedule, providing samples of plastics, upholstery material, paint chips, floor coverings, and similar items as actually incorporated into the remanufactured Railcars, shall be furnished to PM.

1.3 DESIGN SUBMITTALS

1.3.1 Engineering Review Meetings

Engineering review meetings may be held from time to time by the Contractor in order to brief the Engineer on the status of the design, layout and progress of the Railcars and Locomotives , their systems and components. These meetings may be attended by representatives of the Contractor, appropriate subcontractors and the Engineer. Minutes of these meetings shall be prepared by the Contractor and provided to the Engineer for information.

1.3.2 Requirements for Drawings, Documents and Data

Drawings and documentation shall be required for the following aspects of the work, where unique for each Railcar type.

- General arrangement showing apparatus and systems (new and existing) in their final configuration.

- Any new structural members (and their connections) applied to the Railcars or Locomotives.

- Structural modification to Railcar bodies

- Layout and design of new systems and apparatus (Systems Drawings)

- Wiring schematic

- Pneumatic schematic

- Stress analysis of modifications and structural repairs as may be determined by the Contractor to meet Specifications requirements.

All dimensions shall be expressed in the English system; all wording shall be in English language. All terminology used shall be conventional to the U.S. transit and railroad industries.

Drawings shall have a title block which includes drawing number, title, date, revision number, and reference to next higher assembly where applicable. Drawings made by the Contractor shall be checked by the Contractor to ensure that they conform to the Specifications requirements.

Contractor and subcontractor drawings shall be of a scale and line density to be of microfilm quality and to convey content.

Drawings shall include a list of materials and parts on the field of the drawings or on a separate sheet of the same drawing, describing parts or sub-assemblies, including subcontractor-furnished items which form a part of the assembly, subassembly, or piece depicted.

For any work beyond the scope of the Specifications a change request (CR) must be submitted before any document, drawing, or data revisions are made. No revisions to Approved documents, drawings, or data shall be made without an agreed CR.

Drawings supplied by the Contractor shall be delineated in a manner that permits the wiring, piping, and mechanical interface relationships between components furnished by the Contractor and its subcontractors to be clearly identifiable.

Whenever reference is made on a drawing to a material or process by the Contractor's own specification number the Contractor shall provide copies of its specification.

1.3.3 Approval Requirements

In the interest of maintaining schedule and expediting the delivery of the Trainset, conditional Approval, if warranted, will be granted by PM on the basis of sketches, marked-up existing drawings and handwritten notes and calculations during work on the Railcars, Locomotives and/or mock-ups. Such preliminary effort shall be followed by formal drawings.

The Contractor shall submit for Approval, two (2) copies each of General Arrangements drawings, systems drawings, interior finish drawings and test memos necessary to demonstrate compliance with the Specifications requirements.

Within forty-eight (48) hours of receipt thereof, the Engineer shall review and Approve or take other appropriate action upon the Contractor's drawing and test memo submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Agreement. The Engineer's action will be taken so as to cause no delay in the Contractor's work or in-the activities of the Contractor. The Contractor shall provide drawings for Approval to the Engineer at the Contractor's facility. If more than ten (10) drawings or test memos are submitted at one time by the Contractor, the Engineer shall complete his review within five (5) business days.

Review of such submittals will not be conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Agreement. The Engineer's review will not constitute approval of safety precautions or, unless specifically stated by the Engineer of any construction means, methods, techniques, sequences, or procedures. The Engineer's Approval of a specific item does not indicate Approval of an entire assembly of which the item is a component.

If Approved, each of the drawings requiring Approval shall be identified as having received such Approval by being stamped "Conformed" and dated. Such drawings stamped "Non-Conforming" and with required corrections shown will be returned to the Contractor for correction and resubmittal. Resubmittal will be handled in the same manner as first submittals.

FIGURE 1-1
PM DRAWING DISPOSITION STAMP

Contract Name: ____________________ Contract No. ______________

Conformed ( )

Non Conforming ( )

"Conformed" does not relieve the Contractor from responsibility for any errors or omissions in these submittals and/or shop drawings or from responsibility for complying with the requirements of the Agreement.

Philip Morris

By: ______________________ Date: ___________

1.3.4 Submittal Form

All Contractor submissions of drawings, test memos and other documentation to the Engineer shall be accompanied by a suitable submittal form listing such documentation.

1.3.5 Contractor's As-Built Drawings

The Contractor shall supply PM, within 180 days after Final Acceptance of the Trainset the following drawings:

- As-built drawings of any new or modified apparatus, assemblies and subassemblies on the Railcars and Locomotives;
- Appropriate as-built drawings of those apparatus, assemblies, subassemblies, and arrangements which are necessary for periodic and extraordinary maintenance or repair of the Railcars;
- As-built schematic wiring and connection diagrams;
- As-built schematic piping and connection diagrams.

Drawings shall have engineering and manufacturing changes incorporated and shall accurately depict the as-built condition of the Railcar.

In addition to paper copies, Contractor-prepared drawings shall be supplied in electronic format. The preferred format is Integraph, although drawings in Autocad or other compatible ("DXF" Files) formats are also acceptable. Drawings that do not exist in the electronic format identified herein shall be submitted in hard copy on Mylar base film (1 set) and paper prints (1 set).

1.3.6 Bill of Material

The Contractor shall finish two (2) copies of an indexed Bill of Material. The Bill of Material shall accurately reflect the configuration of all cars as remanufactured under the Agreement.

If necessary, individual-car supplements to the basic Bill of Material shall be provided to reflect differences among cars, such as those resulting from necessary structural repairs unique to specific cars.

1.4 MANUALS

1.4.1 General

The Contractor shall develop, assemble and provide two (2) types of manuals covering the operations and maintenance procedures for major systems on each type of remanufactured car. These manual types are:

- Operator's Manual
- Maintenance and Repair Manual

The foregoing manuals shall be provided for each of the following Railcars:

1) Power Car
2) Staff/22 and Staff/8
3) Sleeper Car
4) Dining Car
5) Lounge Car
6) Spa Car

Manual shall be indexed and organized in a logical manner. Each manual section shall be provided with its own Table of Contents. Each section shall present one or more locator diagrams with referenced call-outs to locate and identify carborne apparatus.

1.4.2 Operator's Manual

The Operator's Manual shall be developed by the Contractor and shall incorporate all information needed by engineering and train crew to operate the Railcars.

The Contractor shall develop the manual to describe Railcar operations under both normal and abnormal conditions, and shall recognize operating interfaces among Railcar systems.

In all cases, the Contractor shall indicate safety advisories and warnings associated with the remanufactured Railcar and its systems.

The Operator's Manual shall be loose leaf bound.

The Contractor shall provide to PM five (5) sets of Operator's Manuals no later than Provisional Acceptance of Railcar type.

1.4.3 Maintenance and Repair Manual

The Maintenance and Repair Manual shall provide information necessary to perform servicing, inspection, troubleshooting, preventive maintenance, and running repair maintenance on the cars. A preventive maintenance schedule based on manufacturers' recommendations shall be provided. For new and modified equipment, the Contractor shall provide all information and manufacturers' recommendations for servicing and running repair.

Manual material may take the form of new text developed by the Contractor specifically for these Railcars or basic OEM maintenance manuals applicable to the apparatus installed. In either case, the Contractor shall describe the interfaces and their required attention among new and original, and purchased and Contractor-provided, apparatus and systems. The necessary integration of manual materials shall be performed by the Contractor. OEM manuals shall be neatly bound.

The manual shall include schematic wiring and connection diagrams illustrating wiring and electrical apparatus on the remanufactured Railcars. Schematic piping and connection diagrams shall be included to illustrate piping layout and apparatus.

The Maintenance and Repair Manual shall be loose leaf type, using standard size 8½ inch by 11 inch paper.

The Contractor shall provide to PM five (5) sets of approved, complete, Maintenance and Repair Manuals no later than sixty (60) days after Provisional acceptance of the first car.

1.4.6 Manual Format

Standard sized manuals shall be reproduced on pages that are 8½ by 11 inches and which are standard three-ring bound along the 11 inch dimension. The binder cover shall be 10 inches to 10½ inches wide (depending on ring size) and 11½ inches to 12 inches high. The binders shall not exceed 3 inches in overall thickness. Folded pages will be permitted (11 x 17 inches, "Z"-folded) where the information to be conveyed cannot be presented clearly on single pages. Manuals using 8½ by 11 inch pages may be divided into multiple volumes if the required material cannot be accommodated within the maximum binder thickness. Cross references and a Table of Contents shall be provided in each volume.

All covers shall be approximately 1/16 inch thick, resistant to oil, moisture, and wear to a high degree commensurate with their intended uses. Final sets of manuals shall be serialized. The numbers shall be permanently marked on the spine of the cover. Loose-leaf metal binder rings with locks shall be used to prevent undesired opening and to provide positive engagement when closed. Diagrams and illustrations shall not be loose or in pockets.

All printed material shall be clearly reproducible by dry copying machines.

Tabs or other means shall be used to readily identify manual sections. OEM manuals shall be supplied in the manufacturer's format and shall neatly fit within the binder.

1.5 INSPECTION

1.5.1 General

Inspection of the new components shall be the responsibility of the Contractor and, where determined necessary by the Contractor, shall be at the plant of the supplier, giving it every opportunity to correct, under factory conditions, any inadequacies found. Further inspection at the Contractor's facility will determine any damage in transit, plus any unforeseen failure of the equipment that may become apparent. The Contractor is solely responsible for ensuring that its suppliers provide the necessary inspections.

An Engineer will be provided by PM in the Contractor's Plant from the beginning of any substantive work on the first Railcar until the last Railcar is delivered. The inspector will be responsible for confirming conformance with the Specifications of all work done on the Railcars by the Contractor. The Engineer shall be PM's interface with the Contractor for authorization of any "Extra Work" which may be required. Such "Extra Work" shall be accomplished only after Contractor's written agreement to do so in accordance with the changes provisions of the Agreement.

1.5.2 Certificates of Compliance

PM shall accept the use of certain materials if such materials are provided a Certificate of Compliance, in lieu of testing. Each Certificate of Compliance shall be signed by the manufacturer of the material, indicating that the materials involved comply in all respects with the requirements of the Specifications. Contractor shall provide a copy of each Certificate of Compliance to PM and clearly state the location and use of such material(s) and the applicable ?.

Materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of such Certificate of Compliance shall not relieve the Contractor of responsibility for insuring that the material conforms to the requirements of the Agreement and such material which does not conform to such requirements will be subject to rejection, whether in place or not.

1.5.3 Marking

Material, components, and apparatus which have been inspected and Accepted by PM shall be so marked so that they can be identified readily.

1.5.4 Rejected Material

Material or apparatus intended for use on the Railcars or the parts thereof, which has been rejected by authorized representatives of PM or Contractor as unsuitable or not in conformity with the Specifications shall be either; (a) corrected to fully comply with the Specifications, or, (b) shall be clearly marked and so disposed of as to assure that it shall not be used or offered for use again on the Railcars. In the latter case, the proper replacement material shall be promptly obtained by the Contractor as may be required.

1.5.5 Car History Books

The Contractor shall furnish to PM one 8½ inch by 11 inch loose-leaf Car History Book for each Railcar, the pages of which shall be reproducible by a photocopy process. It shall record the following information as a minimum:

- Old and new Railcar number
- Copy of joint departure inspection report
- Written report of each test performed on the Railcar or its apparatus
- Where available, serial numbers of all wheels, axles, engine components, transmission components, and any other apparatus with serial numbers on the Railcar
- Weight of Railcar as delivered to PM
- Wheel and axle mounting records
- All approved contract changes (Extra Work) incorporated into the Railcar

Each Car History Book shall be provided to PM within 30 days of the respective Railcar's Final Acceptance.

1.6 DELIVERY-ACCEPTANCE CRITERIA

1.6.1 Test Plan

The Contractor shall submit a Test Plan covering all tests listed in Section 4 and otherwise specified in the Specifications. The Test Plan shall cover all supplier and subcontractor tests to be completed at the supplier or subcontractor plant and all tests to be completed at the Contractor's plant prior to issuance by PM's Engineer of a Certificate of Provisional Acceptance. It should be noted that certain Qualification Tests need not be performed if the Contractor provides an appropriate Certificate of

Conformance in accordance with the requirements of Section 1.5.2. The Engineer shall be promptly provided a copy of the Test Plan when issued or amended.

The providing of the Test Plan to the Engineer does not in any way, relieve the Contractor of its responsibilities under the Specifications or Agreement.

1.6.2 Required Tests

As a minimum, the tests listed in Sections 4.42 and 4.3.3, and as otherwise specified in the Specifications, must be conducted by the Contractor and the test results must demonstrate conformance to the Specifications in order for PM to issue a "Certificate of Provisional Acceptance".

1.6.3 Certificate of Provisional Acceptance

A "Certificate of Provisional Acceptance" for each Railcar and Locomotive shall be supplied to the Contractor by PM's Engineer when all applicable tests listed in Sections 4.4.2 and 4.3.3 have been completed demonstrating conformance to the Specifications.

1.6.4 Final Acceptance Certificate(s)

A "Certificate of Final Acceptance" shall be issued for each Railcar and Locomotive in the Trainset by PM to the Contractor upon Final Acceptance and of the Trainset.

1.7 DELIVERABLE LIST

The following tabulation consolidates and identifies the deliverables required by the Specifications and shows the Specifications Section describing each.

Deliverable Number	Spec Section	Description
Section 1	Scope, Responsibilities, Inspections	
D1-1	1.2.6	Serial Numbers
D1-2	1.2.7	Results and testing of inspections
D1-3	1.2.8	Interior material samples - as-built
D1-4	1.3.3	Contract drawings
D1-5	1.3.5	As-built schematic wiring and connection diagrams

D1-6	1.3.5	As-built schematic piping and connection diagrams
D1-7	1.4.2	Operator's Manual
D1-8	1.4.3	Maintenance and Repair Manual
D1-9	1.5.2	Certificates of Compliance
D1-10	1.9.5	Car History Books
D1-11	1.6.1	Test Plan
<u>Section 2</u>	<u>Design Requirements</u>	
D2-1	2.2	Underfloor equipment arrangements
D2-2	2.2	Dynamic outline of car
D2-3	2.3.2	Weight and balance measurements
D2-4	2.5.3.2	Exterior equipment enclosures - design and construction.
D2-5	2.5.3.3	Details of electrical equipment arrangement
D2-6	2.8.1	Detailed list of expendable spare parts and consumables
D2-7	2.6.3, 9.1.5	Vibration-isolation mounts
<u>Section 3</u>	<u>Quality Assurance</u>	
D3-1	3.2.1.9	Test Plan
<u>Section 4</u>	<u>Tests and Adjusments</u>	
D4-1	4.1.2	Advance notice of testing
D4-2	4.1.3	Test Plan
D4-3	4.1.3	Detailed test procedures
D4-4	4.1.3	Seat frame
D4-5	4.2.3	Windows
D4-6	4.	Lining materials and insulation

D4-7	4.2.4	Temperature control
D4-8	4.2.4	Refrigerant charge determination
D4-9	4.2.4	Maximum operating conditions
D4-10	9.1.4	Power Car generator system
D4-11	4.2.4, 8	Ventilation air balance
D4-12	4.2.8	Cooling capacity verification
D4-13	4.2.12.7	Shunt trip operation
D4-14	4.2.9	Lighting Schematics
D4-15	2.22	Clearance
D4-16	2.1.2	Trainline
D4-17	4.2.5	Braking
D4-18	4.4.1	Wheel slide
D4-19	15.2.16.3	Signal shunting
D4-20	9.1.4.3	Battery and battery charging equipment
D4-21	15.3.3	Electrical equipment
D4-22	9.1.4.3	Battery system
D4-23	15.3.5	AC motors
D4-24	4.2.5	Air brake equipment
D4-25	4.3.4	Air conditioning
D4-26	4.3.4	Communication system
D4-27	2.1.2	Car wiring diagrams
D4-28	4.3.4	Heating
D4-29	4.3.4	Auxiliary circuits and equipment
D4-30	4.3.4	System functional verification
D4-31	2.3.3	Car weighing
D4-32	4.3.4	Generator set emergency fuel shut-off and reset

D4-33	4.3.4	Pre-delivery inspection
D4-34	4.4	Functional tests
D4-35	4.4.1	Trainset performance
D4-36	4.4.1	Final Acceptance Test

<u>Section 5</u> <u>Materials and Workmanship</u>

Materials and workmanship deliverables are not separately called-out here but shall be provided by the Contractor in accordance with the applicable portions of Section 5.

D5-1	5.10, 5.11	Passenger seat designs, cushion, construction and color scheme
D5-2	11.14, 3	Seat securement method
D5-3	11.14.3	Seat strength test reports

<u>Section 11</u> <u>Trucks</u>

D7-1	7.1	Truck frame repair procedures
D7-2	7.3	Bushing supplier list
D7-3	7.4	Truck bolster and spring plank repair procedures
D7-4	7.8.4.2	Equalizer reclaim provider
D7-5	7.8.4.2	Equalizer normalizing and tempering procedures
D7-6	7.10	Spring supplier
D7-8	7.11.4.2	Swing hanger and cross bar normalizing and tempering procedures
D7-9	7.12.4	Journal bearing type and manufacturer
D7-10	7.4	Truck wiring for sensors

<u>Section 8</u> <u>Brake Systems</u>

D8-1	9.1	Lighting system design and installation
D8-2	14.-18.	Use of quick-disconnects on wiring

D8-3	8.1, 8.2	Brake equipment rebuild shop
D8-4	8.3	Repair of truck-mounted brake structural members
D8-5	8.4	Automatic drain valve control

Section 9

D9-1	9.5	HVAC baseline or optional system
D9-2	9.5	Refrigerant charging procedure
D9-3	9.5	Air cooling and heating loads analysis
D9-4	9.5	Air flow requirements
D9-5	9.5	Evaporator coil design
D9-6	9.5	Compressor data
D9-7	9.5	Condenser coil design
D9-8	9.5	Temperature control arrangement
D9-10	9.5	Pressures and temperatures
D9-11	9.5	Reheat capacity
D9-12	9.5	Evacuation and test procedures
D9-13	9.5	Electrical and control arrangement schematics
D9-14	9.1.4	Power Car electrical power systems
D9-15	9.1.5.1	Trainline junction box location
D9-16	9.6.1	Communication system design, manufacturer, and installation
D9-17	9.6.2	PA system amplifier
D9-18	9.6.2.2	Interior and exterior speaker location
D9-19	9.6.4	Passenger emergency communication system

Section 10	Misc. Railcar Items	
D10-1	10.4.1	Interior and exterior graphics
D10-2	10.4.2	Contractor's name plate
D10-3	10.5	Fire extinguisher size, design and securement
D10-4	10.6	Emergency tool box installation

Section 11	Railcar General	
D11-1	11.7.1	Carbody end doorway design
D11-2	11.8.1	Structural analysis of new, modified and repaired structure
D11-3	11.12.1	Threshold fastening
D11-4	11.13.3	Body end door hold open device
D11-5	11.13.1	Body end door design, construction, and installation
D11-6	11.7.1,11.15.2, 11.16	ADA compliance
D11-7	11.19.1	Interior color scheme
D11-8	11.19.2	Interior Lining installation
D11-9	4.2.3., 11.20	Window glazing design, material qualifications and installation
D11-10	11.16.3, 18.11	Emergency escape sash design, installation and location

DESIGN CRITERIA
SECTION 2

2.1 DESIGN REQUIREMENTS

2.1.1 General

This Section establishes performance, environmental, and general design criteria for the remanufactured and Railcars. Included are configuration, capacity, dimensional, performance, environmental, noise and vibration, weight, and other requirements which impact Railcar system and subsystem design. These requirements apply to all aspects of Railcars, Locomotives equipment design to the extent applicable.

The Railcars and Locomotives shall be remanufactured and modified to operate successfully in the environmental conditions prescribed in Section 2.4. All requirements identified herein shall be met. If questions or conflicts arise within the Specifications, the Engineer shall be notified. Resolutions to questions or conflicts must be obtained without impact to design and manufacturing schedules.

Subject to the Contractor's recommended maintenance practices and normal industry-accepted operating procedures, the Railcars shall be remanufactured for a normal service maximum speed of 79 mph (maximum design speed of 85 mph) and a minimum service life of 15 years. Annual design mileage shall be 50,000 miles per car.

2.1.2 Amtrak Interchange Requirements

Contractor shall provide the Railcars so that they are capable of interchange with Amtrak trains. In order to meet the requirements of operations, Amtrak current Private Car Specification, Appendix "A" to this Section 2 shall be used as the required design criteria for the Railcars. In the event of a conflict between the Specifications and Amtrak's Private Car Specifications, the requirements of Amtrak's Private Car Specifications shall govern.

Although Amtrak's Private Car Specifications place responsibility on the "car owner" for the preparation, operational tests and inspections of the cars, Contractor shall be responsible for such items under the Agreement. It is understood that the Railcars are substantially taller than permitted by Amtrak's standard clearance diagram and hence will be able to operate only in limited Amtrak service.

2.1.3 Mobility-Impaired Provisions

The Railcars shall be equipped with special provisions for mobility-impaired passengers. The Contractor shall comply with the following, except that only one Sleeper Car shall contain ADA in-cabin facilities since the Railcars are designed to operate as a single trainset:

- Requirements of the Architectural and Transportation Barriers Compliance Board contained in 36 CFR Part 1192; "Americans With Disabilities Act (ADA), Accessibility Guidelines for Transportation Vehicles; Final Guidelines."

- 49 CFR Parts 27, 37, and 38; "Transportation for Individuals With Disabilities; Final Rule. "

Applicable Railcars shall be designed and built as required to accommodate access by mobility-impaired passengers in wheelchairs. Body end doorways shall provide a clear opening of at least 32 inches in width and shall be equipped with sliding doors. The collision post doors or the vestibule side doors shall reflect the Specifications requirements.

The Railcar interiors having ADA provisions for wheelchair passengers are shown on the Contract Drawings.

The Railcars shall <u>not</u> be equipped with wheelchair lifts for lifting from trackside to the Railcars.

2.1.4 Car Numbers and Present Configuration

Cars available for remanufacture and are indicated below. They shall be remanufactured in a sequence determined by the Contractor in accordance with the Production Plan and consistent with the Agreement delivery dates.

The underfloor equipment locations are not identical on all Railcars, however, the Contractor shall exercise best efforts to standardize underfloor arrangements for Railcars of a similar type.

The Contractor shall maintain a record of each Railcar's original builder's number. Underframes shall be marked to identify the original builder's number. A Car History bank shall be provided by the Contractor for each remanufactured Railcar.

2.2 CAR DIMENSIONS

The Railcar dimensions contained herein are based on typical as-built data from the Contractor's records. Dimensions of each Railcar shall be confirmed by measurement prior to Provisional Acceptance.

SLEEPER CAR CHARACTERISTICS	DIMENSION FEET	INCHES
Length of Railcar over pulling face of couplers	85	0

Distance (center-to-center) between trucks	59	6
Maximum interior width of Railcar body (24" to 30" above floorline)		112
Height, top-of-rail to top of finish floor at bolster, new wheels		50
Maximum height, top of rail to top of carbody	17	5
Coupler height above top-of-rail (nominal)		34±½
Minimum side door clear opening at end vestibule		36
Minimum width of body end door opening		32
Wheel diameter nominal		36
Wheel gauge nominal		4'8½"
Truck wheelbase	8	6

A clearance of at least 1½ inch, exclusive of positive stops, shall be provided between truck parts and carbody parts under the most unfavorable conditions of track curvature, wheel wear, lateral and vertical motion and roll, and broken springs. No part of the Railcar or trucks except wheels shall be less than 2¾ inches above the plane of the top of the rail under any combination of conditions, including fully-worn wheels and primary suspension and secondary suspension spring deflection.

The Contractor shall submit for Approval a dynamic outline of the Railcar showing clearance diagrams which reflect all under-, side, or roof-mounted equipment under conditions which consider the maximum truck lateral, vertical, and roll suspension limits and maximum wheel wear.

2.3 WEIGHTS

2.3.1 General

The estimated maximum weight of an empty Sleeper as of the signing the Agreement is 165,000 pounds each. Railcar weight shall be confirmed by the Contractor prior to Provisional Acceptance.

For the purpose of determining total passenger loads, a weight of 155 lbs. per passenger and 350 lbs. per wheelchair passenger, including wheelchairs shall be used in calculations, where required.

2.3.2 Weight and Balance

The Railcars shall meet the following weight and balance requirements:

- Difference in weight carried by "A" end and "B" end trucks shall not exceed five percent.
- The lateral imbalance shall not exceed 60,000 inch-pounds.

The weight distribution shall be confirmed by weighing the First Sleeper Car with a load cell at each wheel, by weighing the Railcar body with a load cell at each jacking pad or by other approved means. The Contractor shall provide final weight balance and placement of equipment to the Engineer.

If the weight imbalance on a Railcar is greater than allowed above, the Contractor shall prepare a plan for correction of the imbalance to the specified level and the Railcar shall be modified to the plan. All Railcars of a similar type from the shall be rebuilt to the as modified plan for the correction of the weight imbalance.

2.3.3 Railcar Weighing

Each remanufactured Railcar shall be weighed with load cells at each wheel simultaneously. Alternatively, a railroad track scale shall be used for this purpose with each end of each Railcar weighed separately and the two weights summed for the total Railcar weight. The weight tickets shall be made a part of the "Car History Book".

2.4 OPERATING ENVIRONMENT

2.4.1 Right-of-Way Interface

The track on which the remanufactured Railcars and Locomotives will operate will not exceed the following threshold conditions:

TRACK CHARACTERISTICS	DIMENSION
Minimum radius of track horizontal curve with cars coupled	250 feet
Minimum frog no. - crossover between tracks on 12 foot 0 inch centers	No. 6½
Minimum radius of vertical curve with cars coupled	2,000 feet
Maximum superelevation	7 inches
Track gauge (nominal)	4 feet 8½ inches

All trackage will be maintained to at least the minimum requirements of the FRA Track Safety Standards for the speeds operated.

2.4.2 Climatic Conditions

All equipment on the Railcars shall be designed for normal, safe operation at the most severe specified ambient conditions assuming maximum power supply tolerances. The ambient is defined as the temperature, humidity, and environment of the area around the car; actual temperatures and conditions within the Railcar body, above it, or under it may be more severe. The Contractor shall be responsible for evaluating environmental effects during its design effort.

The design ambient conditions shall be as follows:

- Temperature and Solar Load:
  - Minimum ambient air temperature, external to equipment: 0°F
  - maximum ambient air temperature, external to equipment: 115°F
  - Maximum daily temperature range: 60°F
- Wind:
  - Average speed: 11 mph
  - Maximum sustained for 1 minute: 73 mph
  - Maximum gusting: 80 mph

The temperatures shown represent only ambient conditions. The effect of increased temperatures due to solar radiation on the carbody and heat produced during operation of equipment under the environmental extremes specified above must not result in degradation of equipment performance or equipment reliability. Also, the effects of prolonged cold and wind chill shall not result in degradation of equipment performance, reliability or physical characteristics.

The Railcars must be able to operate in water up to 2 inches (51 mm) above the TOR for a distance of 400 feet (121.9 m) at speeds up to 10 mph (16.1 kph).

2.5 EQUIPMENT DESIGN

2.5.1 System Voltages

2.5.1.1 Head End Power (HEP) System

The Contractor shall provide a 480-volt, 60 Hz, 3-phase Head End Power (HEP) system. This system shall provide power for the Intermediate Power Supply, air conditioning system, other auxiliary loads, and the Low Voltage Power System and shall be supplied by the generators installed in the Power Car.

2.5.1.2 Low Voltage DC Power

A new low voltage DC power supply and battery charger, operating from the 480 VAC system and batteries, shall be provided on each Railcar. The low voltage system shall be a nominal 12 VDC and the storage batteries shall have a nominal 12 VDC rating. Low voltage lighting and emergency services shall be energized from these sources.

2.5.1.3 Methods and Equipment

The Contractor shall employ design techniques, construction methods, and whatever equipment is required to prevent interference caused by internal sources from affecting the proper operation of Railcar systems. Interconnecting power and signal cables shall be physically separated. Trainlines shall be located and arranged to minimize voltage induction into trainline circuits.

2.5.2 Pneumatic Pressures

Pneumatic system pressures shall be as follows:

	Normal Operating Range	Maximum
Main Reservoir Pressure	130-150 psig	150 psig*
Brake Pipe Pressure	90-110 psig	110 psig

* Safety valve setting.

2.5.3 Exterior Equipment Enclosures

2.5.3.1 General

Undercar equipment with a direct line of sight to a wheel from any possible truck orientation shall be protected from water splash, flying rock ballast, or other objects that may be thrown by the wheel. If separately-mounted, solid-metal shields are used to provide such protection, they shall not hinder clear maintenance access.

Underfloor-mounted equipment enclosures shall be watertight when subjected to wheel spray, Railcar washing and driving rain.

2.5.3.2 New Underfloor Enclosures

New underfloor equipment enclosures shall be constructed of LAHT, carbon steel, or stainless steel, as appropriate for the application except where otherwise specified.

Equipment shall be arranged for the maximum ventilation of parts and the minimum restriction of cooling air. The high temperature air exhausted from one piece of equipment shall not be directed toward the air intake of another piece of equipment.

All underfloor equipment shall be arranged to allow ready access from the side of the Railcar or from the maintenance pits. Devices which may require in-service access shall be located in side-of-car accessible positions.

Enclosure covers shall be provided with quick-release, spring-loaded latches. All hardware, latches and hinges shall be stainless steel.

Enclosure covers shall be equipped with internal "hold open" features.

Enclosures, covers, and doors of a given type shall be interchangeable among cars.

2.5.3.3 Electrical Interface

The arrangement for conduit, cable, wire routing, connections to equipment enclosures, and equipment contained in enclosures shall be configured so that structural, electrical and environmental integrity is maintained, and so that the removal and replacement of the equipment enclosure is facilitated.

All control and power cable terminations shall be internal to the enclosures or in waterproof, gasketed junction boxes. Cable entry shall be by means of watertight sealing glands.

Conduit shall be connected to underfloor equipment groups using watertight connectors as manufactured by Universal, Erickson, or equal.

2.5.6 General Equipment Requirements

The Contractor shall define the design factors affecting maintainability and reliability for new equipment applied to the Railcars. Factors that the Contractor shall consider in its design development shall include the following:

- Human interfaces with all equipment shall be designed by taking into account generally accepted ergonomic principles.

- Equipment boxes shall be mounted to allow adequate space for maintenance. Doors shall be provided where access to lights, switches, breakers, or maintenance indicators is required.

- Access panels secured with fasteners may be provided instead of doors and if maintenance cycles are planned at one (1) year or greater intervals.

- All mounting hardware on the Railcar shall be inch system, hex head, UNC and UNF.

- Fasteners within a component or assembly shall be either U.S. or metric, not a mixture of both. Components at all levels of assemblies and subassemblies shall be mounted so that the mounting hardware is completely accessible with standard tools. Mounting hardware shall be hex head UNC or UNF.

- Wire harnesses, pipes, support brackets and other appurtenances shall not obstruct mounting hardware fasteners.

2.5.8 Interchangeability

All apparatus supplied by manufacturers for installation on Railcars remanufactured under the Agreement shall be interchangeable among Railcars to the extent practical and consistent with the varying Railcar designs. Replaceable components of any such apparatus shall be fully interchangeable, without adjustment to any part or system of the Railcar, as far as possible. The use of parts whose replacement may require an adjustment will only be used to the extent absolutely necessary.

2.6 NOISE AND VIBRATION

2.6.1 Wayside Noise Level

The wayside noise environment created by the Railcar shall be in compliance with the standards presented in 40 CFR Part 201 and the compliance regulations of 49CFR Part 210.

2.6.2 Interior Noise Levels

2.6.2.2 Passenger Area Noise

When a single completely assembled and operating Railcar is moving at any speed up to 79 mph on welded rail with tangent, at-grade, ballast-and-tie (either concrete or wood) track all equipment operating simultaneously at normal conditions and with the Railcar operating in any specified mode of acceleration, deceleration, or coasting, the noise level in the Railcars' interior without passenger load, shall not exceed 80 dBA. Measurements shall be taken at a minimum of ten (10) locations not less than one foot from the ceiling, floor, end walls, or side walls.

With the same Railcar at rest immediately following the preceding test and with only the lights, air conditioning and ventilating equipment operating, the noise level in the car's interior shall not exceed 74 dBA. Measurements, their location and the instrumentation used shall be the same as used in the running test.

With the same Railcar at rest, the Locomotives and Power Car shut down, and the wayside receptacle connected to wayside power with only the lights, air conditioning and ventilating equipment operating, the noise level in the Railcar's interior one foot below the ceiling diffusers and return air grilles shall not exceed 68 dBA.

2.6.3 Vibration

When measured with a Railcar at rest, any new or overhauled equipment or auxiliary apparatus mounted anywhere on the Railcar body, or trucks shall not cause vertical or horizontal vibrations anywhere on the vehicle floor, walls, ceiling, panels and seat frames in excess of the following:

- Below 1.4 Hz: Maximum deflection (zero to peak) of 0.10 inch.
- 1.4 Hz to 20 Hz: Peak acceleration of 0.15g.
- Above 20 Hz: Peak velocity of 0.06 in./sec.

2.7 PERFORMANCE

The Trainset characteristics shall be measured during the operational testing of the Trainset as a unit prior to Final Acceptance. Individual Railcars shall undergo braking tests as more fully described in Section 8.1. With full service braking, single Railcar deceleration shall be a minimum of 2.0 mphps between 70 mph and full stop. The maximum instantaneous service brake rate shall not exceed 2.75 mphps. Emergency braking shall provide a minimum single Railcar deceleration of 2.5 mphps between 70 mph and full stop.

Performance curves and supporting data and assumptions for braking shall be developed from the data generated by the Final Acceptance tests described in Section 4.4. Such curves shall be provided to the Engineer with supporting data.

2.8 SPARE APPARATUS

2.8.1 Expendable Spare Parts and Consumables Requirements

At least 90 days before the Provisional Acceptance of the first Railcar, the Contractor shall submit to PM a listing of the stock of spare parts and consumables which the Contractor determines are necessary to maintain all of the Railcars in operation for a period of six months from delivery of the last Railcar. The submission shall contain a list of the spare apparatus, recommended quantities of each along with suppliers' name and ordering data. This list shall recognize the "fresh start" status of the service and provide appropriate levels of spares to provide an initial stock to protect requirements for the first six months of service. The list shall also include long lead time items which may be required during the first year of service. PM's purchase of expendable spare parts and consumables, if any shall be handled as Extra Work.

2.8.2 Warranty Protective Spares

PM will allow the Contractor to draw its warranty spares requirements from PM provided that the Contractor replaces all spare parts borrowed within 30 days (or other time period as agreed to by PM), so as not to leave PM unprotected in its spares requirements.

The Contractor shall maintain those warranty protective spares which it determines are required to protect PM from having Railcars out-of-service due to warranty failure.

2.9 DIES AND PATTERNS

The Contractor shall not permit the destruction or sale of extrusion dies, casting patterns and tools such as drill jigs, welding and assembly fixtures, etc. used in the remanufacture of the carbody, trucks and running gear at any future date without first offering PM the opportunity to acquire same. If sold, PM shall be provided with the name and contact information of the purchaser. This provision shall not, in any manner, modify the terms of the Agreement.

2.10 LIST OF FIGURES

The Contract Drawings included with the Agreement on the date of signing the Agreement are as follows:

Drawing No.	Date	Title
LTNG 00	09/13/94	Schematic Train Consist
LTNG 01	09/13/94	Standard Domed Sleeper Railcar
LTNG 02	09/12/94	General Arrangement for Standard Stateroom
LTNG 03	09/13/94	ADA Domed Sleeper Railcar
LTNG 04	09/13/94	General Arrangement for ADA Stateroom
LTNG 05	09/12/94	Typical Section - Domed Sleeper Railcar
LTNG 06	09/13/94	General Arrangement Dome Diner #15
LTNG 07	09/13/94	General Arrangement Dome Diner #16
LTNG 08	09/13/94	General Arrangement Dome Lounge #17
LTNG 09	09/13/94	General Arrangement Dome Lounge #18
LTNG 10	09/13/94	General Arrangement Dome Lounge #19
LTNG 11	09/13/94	General Arrangement for Low Level Domed Spa Car
LTNG 12	09/13/94	Schematic Railcars #15-20

APPENDIX A
to SECTION 2

INDEX
PRIVATE CAR SPECIFICATION

PRIVATE CAR SPEC

1.0 SCOPE
This document describes Amtrak's minimum requirements for the handling of privately owned cars in Amtrak head end power trains.

The cars are to be capable of being used anywhere in an Amtrak consist without restriction, including full 480V, 1600 Amp, rated trainline for HEP service and a pass-through 27 point communication cable.

*B This spec is to be used as a supplement to Mechanical Instruction SMP #28603, Latest Revision "Inspection of Private Owned Cars," and SMP #25603, "Speed Restriction Policy for Private Cars."

2.0 GENERAL
As used in the specification, these terms shall be understood to mean as follows:

a. The Owner is the owner of the private car.
b. The Builder is the authorized builder and executer of the conversion of the car.
c. Prime Contractor
The car owner shall be designated as the Prime Contractor. The Prime Contractor shall assume the responsibility for the converted car preparation, operational tests, and inspections.

3.0 RESPONSIBILITIES OF OWNER

a. Compliance with Applicable Regulations

The Converted Cars, shall comply in all respects with the Applicable Standards and Recommended Practices adopted by the Associated of American Railroads (AAR); laws, rules and regulations stipulated by the states in which Amtrak trains operate:

ASHRAE	American Society of Heating, Refrigerations and Air Conditioning Engineers Inc.
AREA	American Railway Engineering Association
FDA	Food and Drug Administration of United States Department of Health, Education and Welfare
IES	Illuminating Engineering Society
USPHS	United States Public Health Service of the United States Department of Health, Education and Welfare
ASA	American Standards Association
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
NFPA	National Fire Protection Association
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
IEEE	Institute of Electrical and Electronic Engineers
SAE	Society of Automotive Engineers
DOT	U.S. Department of Transportation
FRA	Federal Railroad Administration of US DOT
NRPC	National Railroad Passenger Corporation

b. Conformity with Specification

Those items in this Specification which differ from the Builder's standard shall be per the Specification unless the Builder obtains Amtrak written approval for change. "Approved Equal" herein refers to those situations wherein the Builder , if he desires to offer substitute items, parts, materials, or equipment in lieu of those designated in this Specification, shall obtain Amtrak approval in writing to make such substitutions. The burden of proof that the substitution is equal shall rest with the Builder. Such written approval does not in any way relieve the Builder of the responsibility for the proper function and adequacy of the installed equipment.

c. Drawings

The Car owner shall maintain copies of the following drawings. Before initial car approval, these drawings must be submitted to Amtrak for review.

a. 27 Point cable and receptacle application
b. 480 volt cable and receptacle application
c. Electrical schematic of any car systems which will be supplied form the HEP trainline system or the 27 point trainline.
d. Piping schematics
e. Electrical Load Chars for cars using HEP (Phase balance must be within 5% full load).
    1. Connected Load Winter
    2. Connected Load Summer
    3. Normal Load Winter
    4. Normal Load Summer
f. Equipment arrangement drawing
g. Car dimensional clearance drawing

4.0 SERVICE COMPATIBILITY

The intention of this spec is to ensure unrestricted use of the private car anywhere in any HEP Amtrak train. To fulfill this requirement the following systems must be compatible and conform to corresponding Amtrak drawings:

a. Brakes
The brake system shall conform to the requirements of Amtrak's Mechanical Instruction SMP #28603, Latest Revision "Inspection of Private Owned Cars" and #25603 "Speed Restriction for Private Cars."

*B

b. Main Reservoir Trainline
A main reservoir of 1" diameter, extra heavy steel pipe is to be provided. All hose connections, shall be double wire braid reinforced (AAR M618) except brake pipe trainline hoses which shall be AAR branded hose (M601) less than 1 year old from date of manufacture. Main reservoir hose connections shall be in the same location as required by AAR for train communication signal hose.

c. Conductor's Signal Line
Present signal air equipment, signal valves, piping and hose may be removed. If conductor's signal trainline is maintained, it shall be labeled as such, as well as the main reservoir trainline.

d. The diaphragms and face plates are to be modified to Specification DM-77-22 to make them compatible to Amfleet and Conventional HEP cars. Superliner compatibility requires removal of the diaphragms.

e. <u>480 Volt HEP Trainline System</u>

Four identical car mounted Pyle National Co.'s or equal 480 volt receptacles shall be mounted on each cane end in accordance with drawing SK-D-112779. Receptacles shall conform to Amtrak Specification D-77-24. All power receptacles and plugs shall be painted red and labeled "DANGER 480 VOLTS."

The power trainline wiring installed by the BUILDER shall be open wiring made up of four sets of cables. Each set consisting of three 4/0 cables, four wires per phase, for the 480 volt circuits and, in a separate conduit, ten conductors #10 wires for the power loop control circuit. The cables shall run the full length of the car, terminating at the four power receptacles at each end of the car. Wiring is to comply to Figures 4-7 including truck area protection and cleating.

*B

On each car, leads from the 480 volt power cables shall be routed to a common bus bar located in the main terminal box under the car. This box is to conform to Drawings B-00-1017, E-00-1018, and E-00-1019. If the car uses Amtrak supplied 480 volt power, this shall be taken from the trainlines at the MAIN JUNCTION BOX, conforming to drawing <u>E-01-1306</u> and Figure 7.

*B

f. <u>27 Point Trainline System</u>
The car is to be equipped with 4-27 point receptacles, two per car end, one each on the left and right side. Application is to conform to drawing SK-D-112779. Receptacles are to by Pyle National Model WWRF-27-AMTR-L180, and are to be painted blue.

*B No dummy receptacles are required.
No loop relay panel is required.

The undercar cabling is to be run in a conduit, with a junction box located at each end of the car for the pigtail to carbody wire connections. Communication cable wire size, type and pin assignment shall comply with drawing <u>#E-01-1306</u>.

g. <u>Receptacle Labels and Warnings</u>
Appropriate warnings and identification of all trainline connections shall be prominently displayed on the outside end of the vestibule end sheet. Simplified instructions and directions for connection, disconnection and storage of jumpers shall also be stated, including safety precautions and sequence of operations.

Color coding as follows shall be used to assist personnel in the make-up of trains. Communications - Blue jumper, Blue receptacle; Power - Red Jumper, Red receptacle.

h. Jumper Cable Required

The Builder shall furnish four power jumper cables, Pyle National 51 inch or approved equal. Builder shall furnish one Pyle National WWPCJ-2746-AMTR communication, 60 inch long jumper cable, or Amtrak approved equal, with each car.

i. Jumper Cable System

Electrical trainline connections for three phase power as well as inter-car communications and control circuits shall be made between cars by jumper cables. Connections between the converted cars and between adjacent passengers cars shall meet normal train operating conditions of horizontal curve negotiation, normal track profile and geometry, without pinching, cutting, or stretching of cables. Minimum radius of horizontal track curve with cars coupled - 250'-0".

Cars must successfully negotiate a 250' radius curve without easement to tangent track.

Extreme Crossover condition to be negotiated by coupled cars - #6½ on 12'-0" track centers.

j. Battery Trainline

If existing, to be in working order. If none exists, no new application is required.

k. Marker Lights

Two red, sealed beam, lamps, mounted in stainless steel enclosures, are to be applied to each end of car to serve as marker lights. (Luminator #0103086001 or equal with red lamp G.E. 60 PAR/2/R). Lamp and fixture must be FRA approved in compliance with Amtrak Spec D-77-27. The marker light resistors, one per lamp adjusted to make the lamp comply to the FRA approval. A single center off switch, permanently labeled is to be provided in the electric or switch locker to control the marker lights at each end of the car. Car wiring is to comply with Spec. D-77-27.

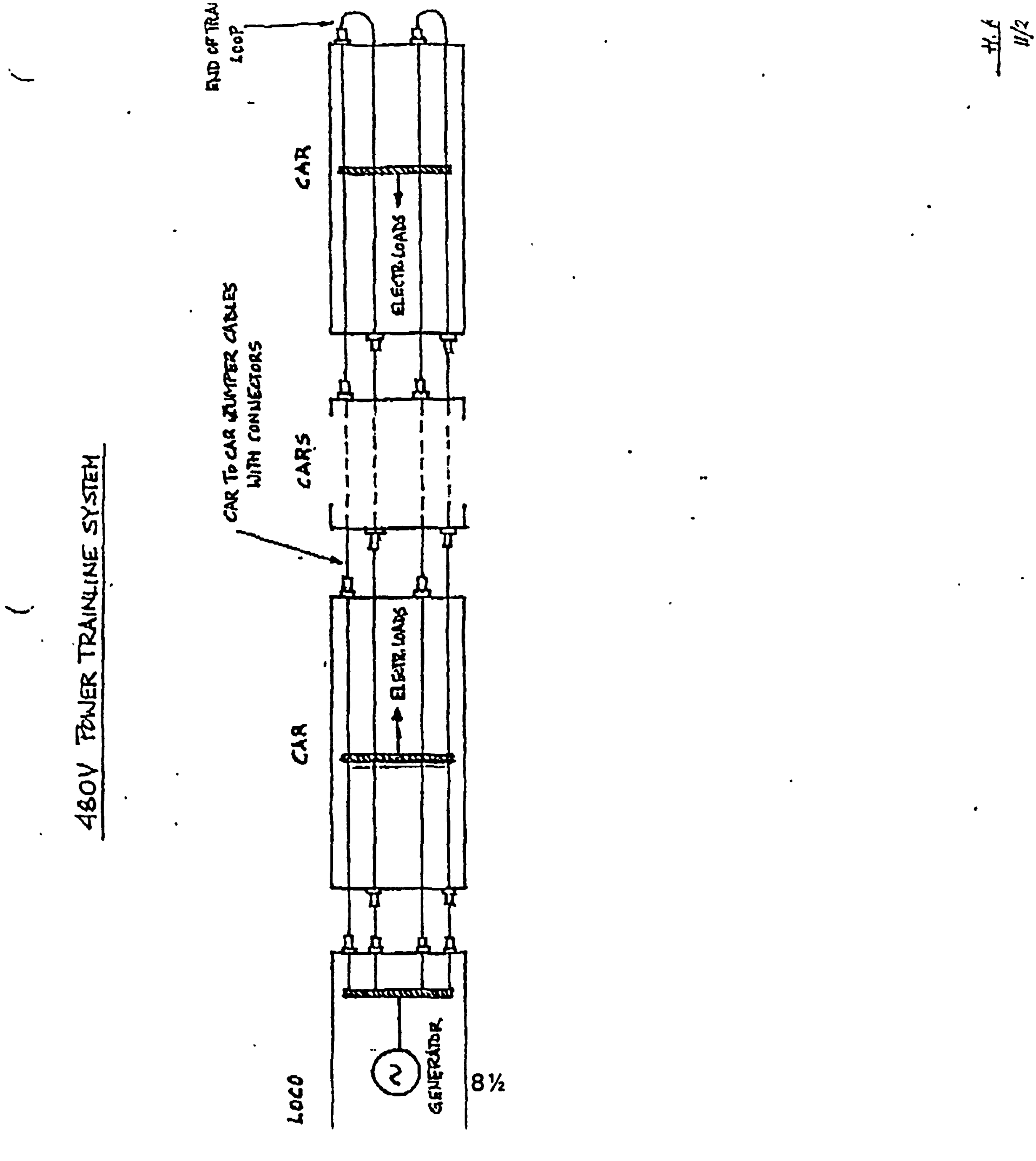
5.0 ELECTRICAL

a. General Wiring

All new conductors shall be Exane (or equivalent), integrally insulated and jacketed, and shall have the properties and characteristics as specified in Amtrak Specifications Q-78-7, except those conductors used for resistors or heater leads, which shall be in accordance with AAR Specification #590.

b. 480 Trainlines

The Main power wiring must be run with all (3) three phases grouped together at all times; if they are separated they must be run thru non magnetic materials to prevent local induction heating. Cable cleats shall conform to figure 4A.



8 1/2

APPENDIX A to SECTION 2

*B Power trainline cables shall be supported by neoprene cable cleats throughout the underfloor with sufficient spacing between individual conductors to permit adequate ventilation.

In the truck areas, these cables shall be protected by running through 3" rigid galvanized steel conduit. All conduit bushings shall be the insulating type.

Phase rotation is A, B, C with pin #1 (black) Phase A, pin #2 (white) Phase B and Pin #3 (red) Phase C.

Lugs used to terminate the 480 volt cables and the receptacle pigtails shall be AMP 326803 and shall be hydraulically crimped with appropriate tools, as recommended by the lug manufacturer. See Figure 6.

c. <u>480 Control Wiring</u>

*C This wiring shall comply with Drawing #E-01-1306. It shall be run in a separate rigid galvanized steel conduit. Only the 480 volt control wires can occupy this conduit. Connections will be only with double-crimped ring-tongue terminals as the drawing specifies. Each connection will be pulled tested to check for proper crimping. These are vital circuits. Also see Figure 6.

*B

d. <u>27 Point Trainlines</u>

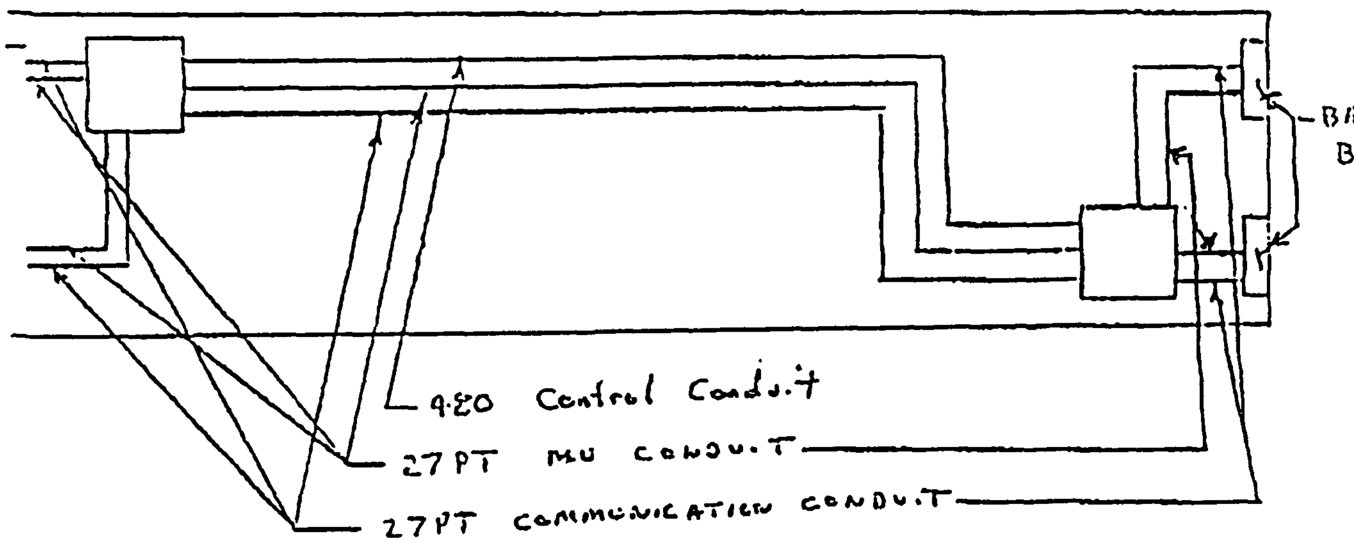
*C The rear of these receptacles shall be enclosed in a water-tight stainless steel box. (Back of receptacles is not intended for exposure to weather.)

27 Point Communication Trainline

This wiring shall comply to Drawing #E-01-1306. It shall be run in its own rigid galvanized steel conduit. Only the 27 Point Communication wires can occupy this conduit. Connections will be only with double crimped ring tongue terminals as the drawing specifies.

27 Point MU Trainline

This wiring shall comply to Drawing C-01-7169. It shall be run in its own rigid galvanized steel conduit. Only the 27 Point MU wires can occupy this conduit. Connections will be only with double crimped ring tongue terminals as the drawing specifies.



Revision C

TRAIN LINE CONDUITS

9½

e. Fitting and Junction Boxes

The fittings, outlet boxes for car wiring shall be as manufactured by the Thomas and Betts Company, Appleton, Crouse-Hinds, Pyle National, or approved equal. All covers for undercar fittings, etc., shall be gasketed using approved materials. Interiors of junction boxes shall be suitable protected by insulating paint against condensation and corrosion. When more than one supplier is used, all fittings which require covers and are of the same size shall be supplied by the same MANUFACTURER.

f. Application and Installation of Wire

All wiring shall be performed by or under the direction of an experienced wireman. The wireman shall be provided with appropriate tools for skinning insulation, cutting, tinning, soldering and attaching mechanical or compression-type terminals to the conductors. Care must be taken in removing insulation from the conductor to avoid nicking of the wire or strands of the conductor cable.

Car wiring methods and materials shall be in accordance with Chapter 3 of the National Fire Protection Association's Publication N.F.P.A. No. 70 (N.E.S.C.) current issue.

g. Splicing - Taping

Splicing of any 480 volt, 480 control trainline, 27 point trainline conductors shall be avoided. Splicing of conductors in conduit will not be permitted. Where it is unavoidable, splices shall be made in junction boxes and the spliced joint shall be as mechanically strong and shall have the same conductivity as any other part of the conductor, without the use of the solder. Approved solderless connectors shall be used for splicing. The joint shall be insulated with tape so as to be at least equivalent to the insulation of the conductor. The outside diameter of the spliced portion of the cable after the tape insulation is applied shall not exceed the outside diameter of the unspliced portion by more than 40%.

h. Tape

An approved polyvinyl chloride electrical tape with Buna "S" type adhesive, 0.007" or 0.010" overall thickness, or approved equal, shall be applied. The above materials shall be suitable for use with the conductor insulation without discoloring or corroding the copper wire and shall provide 600 volt insulation.

i. Terminals

Terminals shall be pre-insulated ring-tongue double crimp type.

Crimp terminals shall be used on all new wiring.

Conductors which will be subject to motion relative to the terminal shall be protected by suitable means to minimize breakage of the conductor at or near the terminal. In general, connections shall be made by means of terminal blocks. Faston on set screw type of connections shall not be use. Solder connections may be used as approved by Amtrak.

j. Marking
All wires and terminal studs as called out on Amtrak drawing shall be plainly and suitable marked, so that circuits may be easily identified. Markings shall be non-conductive.

k. Electrical Grounding
Flexible braided shunts shall be provided between the carbody and truck bolsters, between the truck bolsters and the truck frames, and between the truck frames and the journal bearings.

6.0 CARS USING 480 HEP POWER

Due to the vital nature of the 480 volt trainline system, great care must be taken on any car using HEP to minimize the possibility of 480 volt grounds. All HEP power sources are ground fault protected and will shut down if even a minor fault occurs.

a. Undercar Conduit
All equipment which uses 480 volt power from the HEP trainline system shall have its undercar wiring run in rigid galvanized steel conduit. Exane (or approved equal) - jacketed wire of adequate physical strength may be cleated in place using cleats made of approved synthetic material, at frequent intervals without conduit or raceways, provided strain relief bushings are used at locations leaving and entering conduit, wire raceways or equipment enclosures.

b. Interior Wiring
All HEP fed 480 volt equipment shall be wired with Exane or approved equal. Wiring in interior areas shall be run in either thin wall steel or aluminum conduits, metal ducts, or other raceways designed in an approved manner for the application of electrical wiring. Great care must be taken to minimize the possibility of a ground on any 480 volt wiring or equipment. Should floor heaters be operated on 480 volts, they must be double insulated. BX shall not be used.

c. Segregation of Voltages
Wiring which operates at 480, 240 or 120/208 volts, shall not be placed in the same conduits or ducts with wires operating at battery voltage. Wires operating at different voltages shall not be cabled together. When some parts of a given piece of electrical apparatus are to be connected to line voltage, and other parts to battery, all wiring thereto shall be insulated for line voltage.

d. The 480 trainline tap from the main junction box to the 480 main breaker is to be run in a separate conduit from the junction box to as near the main breaker as possible. This wire shall be very carefully protected against any mechanical injury. This wiring is to conform to Drawing E-01-1306 and Figure 7.

*B e. <u>480 Volt Main Circuit Breaker</u>
The 480 volt main circuit breaker shall be Westinghouse 3 phase FDB frame or EHD circuit breaker, such as FDB-3150. Do not substitute. Provision is to be made to lock open this breaker with a padlock.

f. <u>480 Volt Breakers</u>
All other 480 volt circuit breakers are to be Westinghouse type EHD. (It is recommended 240, 120 VAC breakers be Westinghouse QC-H series.)

g. <u>Electric Locker</u>
The Electric Locker is to be lined with a fire proof material such as CEM-FIL #125S. The floor to have a rubber mat for safety.

All of the 480 and any new 240 and 120VAC circuit breakers and equipment to be provided with a dead front panel and to be completely enclosed. The contactors and relays are to be visible for mode of operations and protected against accidental contact by application of a transparent cover. The panel is to be clearly marked in 2" high letters. (RED)

h. Labels
All new circuit breakers, contactors, push buttons, relays are to be clearly identified with permanent type labels.

7.0 CAR WEIGHT

The Car Builder shall weigh on approved scales each end of the car with trucks prior to shipment. Scale weight tickets shall be furnished to and Amtrak Inspector.

8.0 APPLICABLE AMTRAK DRAWINGS AND ILLUSTRATIONS

RFB 102986	"LISTENING IN"
FIG 3	HEP TRAINLINE CONNECTOR LOCATIONS
C-05-7171	END OF CAR TRAINLINE CONNECTOR LOCATIONS
E-00-1809	FIXED 480V JUMPER CABLE MODIFICATION
E-01-1306	480V & 27 POINT COMMUNICATION TRAINLINE SCHEMATIC
C-01-7169	MU TRAINLINE SCHEMATIC
C-01-1498	27 POINT COMMUNICATION JUMPER CABLE ASSEMBLY
E-00-556	TL COMMUNICATION JUNCTION BOX ASSEMBLY & INSTALLATION
E-00-1017	BUS BAR - 480V JUNCTION BOX
E-00-1018	480V JUNCTION BOX ASSEMBLY
E-00-1019	480V JUNCTION BOX ARRANGEMENT
D-279	PULL BOX
D-0501355	CLEARANCE DIAGRAM

D-77-27	MARKER LIGHT SPECIFICATION, MARKER LIGHT WIRING
Q-78-7	WIRE SPEC
D-77-24	480 JUMPER CABLE

ILLUSTRATIONS

Typical Transformer Installation
Diaphragm Modifications
HEP Trainline Connector Locations
HEP Car J-Box and Cable Arrangement
Cable Cleat
Typical Installation of 480 Pigtail Splices
480V Power and Control Wire Connections
480V Trainline Tap
Approved Marker Light Fixtures
Conductor Signal Button
Ground Strap Installation

9.0 CLEARANCE

The Builder shall submit car dimensions to Amtrak's Chief Mechanical Officer in accordance with Standard Maintenance Procedure (SMP) #28603.

*B

10.0 TESTS AND ADJUSTMENTS

Tests shall include the following (as a minimum). All tests data to be recorded and furnished to Amtrak. Megger, hipot and continuity of 480 power, 480 control and 27 point cable must be witnessed by Amtrak. See Test Spec.

	1.1	Car Clearance
	1.2	Car Curving and Truck Clearance
	2.3	480 Volt Trainline
	2.4	27 Point Trainline - Part C or D
	6.2	Megger/Hipot
*D	6.2.2	480V Trainline Cable
*D	6.2.2B	Private Car Electrical Lead/Phase Balance
	10.2	Carbody Leveling

QUALITY ASSURANCE REQUIREMENTS
SECTION 3

3.1 GENERAL

The Contractor shall be responsible for providing a quality product to PM under the Agreement. To this end, the Contractor shall implement a Quality Assurance Program which shall be maintained throughout the Agreement period. This Section defines the quality assurance efforts required of the Contractor and its subcontractors during the progress of the work.

It is intended to utilize as much of the Contractor's existing quality assurance program as possible while still providing the necessary level of quality assurance activities required to ensure a high quality product.

The elements of the Quality Assurance Program shall be imposed on entities within the Contractor's organization and on manufacturers, subcontractors, and suppliers that perform work to assure that the design, materials, processes and workmanship furnished are in conformance with these Specifications, and that design and manufacturing documentation are developed in a timely manner.

During the performance of the Agreement by the Contractor, PM may also perform quality assurance activities. PM quality assurance functions will be performed in cooperation with the Contractor to ensure that the Contractor is performing the required quality assurance functions and to verify the Contractor's determination that all deliverables under the Agreement conform to the Specifications and to Contractor documentation.

Quality assurance functions required by the Specifications include planning, establishing, and maintaining a Quality Assurance Program.

PM will provide on-site inspection to monitor Contractor work and assist in resolution of quality issues. The presence of PM inspection personnel will in no way diminish the responsibilities of the Contractor under the Agreement.

3.2 QUALITY ASSURANCE PROGRAM

3.2.1 Quality Assurance Program Requirements

The quality assurance program shall provide the following activities consistent with the Work as defined in the Agreement.

3.2.1.1 Design Control

- Control of design inputs and changes thereto, to assure that Specifications design requirements are correctly translated into the drawings and specifications used for procurement, manufacturing, fabrication, and testing.

- Establishment of procedures for transmission of quality requirements and standards to manufacturers, subcontractors and suppliers, and assurance of their compliance.

3.2.1.2 Material Control

- Control of purchased material, equipment, and services to insure that they will be integrated to produce a quality product.

- Control of materials during storage and handling by the Contractor to prevent damage or deterioration.

- Control of materials, parts, components, services and equipment that do not conform to Specifications requirements to prevent their inadvertent use or installation. This control shall include identification, marking, documentation, segregation, and disposition.

3.2.1.3 Manufacturing and Process Control

- Control of manufacturing and production processes through the use of a controlled production plan.

- Control of the qualification of personnel during manufacturing, fabrication, and testing.

- Controls to assure that special processes, such as welding, heat treating, and non-destructive testing are accomplished using personnel and procedures qualified in accordance with industry codes and standards or Specifications requirements where appropriate.

- Identification, control and elimination of conditions adversely affecting product quality.

- Control of all work instructions, procedures, and changes thereto.

3.2.1.4 Testing

- Control of testing to assure that all testing is performed by qualified personnel in accordance with written test procedures. All test results shall be documented, and submitted for review and/or approval where appropriate.

- Control of inspection and test equipment to assure that it is maintained in serviceable condition and within correct calibration. The system shall assure adequate accuracy of equipment and tools used to support the Agreement.

3.2.1.5 Records

- Control of records required to furnish evidence of activities affecting quality.

- Keeping of adequate records to provide evidence of quality and accountability. These records shall be available to PM at all times during the performance of the Agreement.

3.2.1.6 Quality Assurance Procedures

Development of procedures addressing the following areas to support effective implementation of the quality assurance activities discussed in the preceding Sections 3.2.1.1 through 3.2.1.5:

- Design control, including control of technical documentation;
- Transmission of design and quality assurance requirements to procurement sources;
- Appropriate surveillance of subcontractors and suppliers;
- Receiving inspection;
- Production and process control;
- Functional testing;
- Discrepancy control;
- Measuring and test equipment calibration;
- Drawing control;
- Quality assurance records;
- Provisional Acceptance inspection;
- Evaluation of procured articles against purchase order requirements;
- Feedback of problems and their resolutions to the Contractor's Engineering, Production and Purchasing Departments.

3.2.1.7 Quality Control Functions

- <u>Receiving Inspection</u>

  The Contractor's receiving inspection shall provide for the inspection of all incoming materials. All material certifications and test reports used as a basis for acceptance of materials shall be preserved. A material identification system shall be used during manufacture.

- <u>Levels of Inspection</u>

  Specifications of levels of inspection or test shall indicate whether sampling or 100 percent inspection is employed.

- <u>Acceptance Testing</u>

  The Contractor shall determine which items to be delivered under the terms of the Agreement are to be inspected and physically or functionally acceptance tested. Inspection shall occur at a point to assure compliance with drawing and test specifications, process specifications, and quality standards. Nonconforming materials shall be identified, segregated, and reviewed for disposition.

- <u>Change Control</u>

  An acceptable change control system shall be maintained to assure that all material, parts lists, and operational and maintenance data reflect the latest configuration documentation data.

- <u>Procedures</u>

  The Contractor's quality control program shall provide procedures for the completion of inspections.

3.2.1.8 Quality Assurance Organization

The responsibility for the quality assurance function shall be so placed within the Contractor's own organization that schedules and costs will not compromise quality. Management responsibility for the quality assurance function shall be clearly set forth in the Contractor's organization chart. QA personnel shall be indicated by name.

3.2.1.9 Inspection and Test Plan

The Quality Assurance Program shall include an inspection and test plan. Within 60 days of the signing of the Agreement the Contractor shall prepare and submit a test plan to PM showing major testing milestones. The plan shall include a feedback system to the Contractor's engineering, production, and purchasing groups to rectify any problems discovered.

3.3 QUALITY ASSURANCE REVIEWS

3.3.1 General

PM may review the Contractor's Quality Assurance Program and its quality assurance functions to determine compliance with the Specifications.

The Contractor will be notified of all non-conformance issues determined during the reviews. Should PM ascertain valid non-conformance with the Quality Assurance Program the Contractor shall promptly correct the non-conformance. When the non-conformance(s) are corrected PM will be notified.

3.3.2 Review Reports

PM will furnish to the Contractor a written report of each review performed. The review report will describe the scope of the review, the procedures followed in conducting the review; a statement of all deficiencies found, keyed to the Quality Assurance Program; and a suggested action required for each deficiency found.

TESTS AND ADJUSTMENTS
SECTION 4

4.1 GENERAL

4.1.1 Test Types

The tests and adjustments to be performed on the Railcars and PM supplied Locomotives under the Agreement are:

QUALIFICATION TESTS consist of all component, system and Railcar tests to be performed at a manufacturer's or the Contractor's facility one time to demonstrate conformance of the component, system or Railcar with the Specifications requirements. These tests are described in Section 4.2.

PROVISIONAL RAILCAR ACCEPTANCE TESTS consist of all tests to be performed on each Railcar by the Contractor to demonstrate conformance of the Railcar to the Specifications and the Agreement. These tests are described in Section 4.3.

FINAL ACCEPTANCE TESTS consist of those tests of the Railcars and Locomotives for the purpose of demonstrating that the Trainset satisfactorily operates as a unit in accordance with the requirements of the Specifications and the Agreement.

4.1.2 Requirements

The Contractor shall perform all Qualification tests specified herein unless the Contractor can furnish appropriate Certification(s) of Compliance which indicate that equipment furnished meets the requirements of these Specifications.

Unless otherwise indicated in the following paragraphs, all costs associated with any of the tests performed are Baseline Work. In the event of a failure to meet the Specifications requirements in any test, necessary corrections shall be made by the Contractor and the failed test shall be rerun to the extent necessary to demonstrate compliance with the Specifications at the Contractor's expense.

The Contractor shall give at least five (5) working days notice to PM prior to the start of any test referred to herein.

4.1.3 Test Plan and Reports

The Contractor shall provide to PM a Test Plan covering all tests required in the Specifications. The Test Plan shall identify all tests by appropriate reference to the applicable Specifications Section. The Test Plan shall contain a schedule showing date of each test to be performed.

The Test Plan shall be submitted to the Engineer for review.

The Contractor shall prepare a detailed test procedure for each test required by the Specifications. Each test procedure shall be submitted to PM at least ten (10) days prior to the scheduled test.

The Contractor shall provide a written report of each test, including copies of test data to the Engineer. The report shall include a description of the test, raw data collected in the test, all data reduction forms, and a summary of the results in a manner that can be directly compared to the Specifications without further calculation. Contractor shall include a report of selected test results in the appropriate Railcar History Book.

4.2 QUALIFICATION TESTS

4.2.1 General

New, remanufactured and overhauled Railcar systems and materials shall be subject to qualification testing in accordance with Section 4.2.2 unless Specifications compliance can be demonstrated by a Certification of Compliance provided by the supplier of such systems and materials in a form acceptable to the Contractor.

4.2.2 Frequency and Application

The following Qualification Tests shall be performed by the Contractor, or under its direction, to demonstrate conformance to the requirements of the Specifications:

Test	Frequency	Performed By	Reference
Windows	Largest window	Manufacturer	4.2.3
HVAC Equipment	One system and controls	Contractor	4.2.4
Braking Performance	First System	Contractor	4.2.5
Noise	First Sleeper Railcar	Contractor	4.2.6
Watertightness -Ducts	First Sleeper Railcar	Contractor	4.2.7
Watertightness	First Sleeper Railcar & Undercar Boxes	Contractor	4.2.7
Sleeper Railcar HVAC	First Sleeper	Contractor	4.2.8

Test	Frequency	Performed By	Reference
Lighting	First Sleeper Railcar	Contractor	4.2.9
Clearance	Two Railcars	Contractor	4.2.10
Pressurization	Two Railcars	Contractor	4.4.1
Car Operations	Power Railcar	Contractor	9.1.4
Communication System	Trainset	Contractor	4.4
Wheelchair Access Provisions	First Sleeper Railcar	Contractor	4.2.11

4.2.3 Windows

End and side windows, including door windows, of the largest windows of each type specified shall be tested in accordance with 49CFR part 223.

4.2.4 Heating, Ventilation and Air Conditioning (HVAC) Equipment

One complete HVAC unit with all controls shall undergo a Qualification Test by the Contractor to verify the capacity and functioning of heating, ventilation, cooling, and reheat. This test shall be successfully completed prior to the Sleeper Railcar HVAC qualification tests.

Appropriate test log sheets and calculation forms shall be generated and included with the Qualification Test Procedure. They shall become a part of the Qualification Test Report.

The HVAC equipment shall be tested in an independent facility or at the Contractor's facility.

The use of test switches to control the unit independent of the thermostat shall not be permitted.

4.2.5 Friction Brake Performance

Prior to Provisional Acceptance of the First Sleeper, the Contractor shall perform a test of the friction brake system necessary to demonstrate that the system complies with all of the requirements for "Service" and "Emergency" braking response.

Successful completion of all of the friction brake system tests shall be required for Final Approval.

On each Railcar, a test of the hand brake adequacy shall be made.

4.2.6 Noise

The sound levels in the First Sleeper Railcar and each Railcar type shall be checked and verified against the levels specified in Section 2.6. The interior and exterior sound levels of the Railcar shall be verified during the performance test runs against the levels specified.

4.2.7 Water-tightness

The fresh air and exhaust air ventilation intake and exit ducts shall be water tested once with the ventilating fans running at full speed to determine the effectiveness of the water-excluding features of the duct work. The watertightness test specified for all Railcars shall be performed on the First Sleeper Railcar as part of the Qualification Test.

Certain underfloor boxes because of the nature of the equipment they enclose, are required to be watertight. These boxes shall receive a one-time water test.

4.2.8 First Sleeper Railcar HVAC

4.2.8.1 General

The First Sleeper Railcar shall be tested in a "hot room" facility at the Contractor's facility capable of maintaining, as close as possible, the HVAC design temperatures. Temperature in the facility shall be uniform throughout. Fans may be used to circulate air. Passenger load shall be simulated by means of heaters and humidifiers inside the Railcar; solar and equipment loads shall be simulated inside or outside the Railcars. Humidity introduced into the Railcar shall be calculated and measured to simulate the passengers' latent heat load.

The First Sleeper Railcar heating system shall be tested during Winter conditions at a location selected by the Contractor. Contractor may use a suitable heating and circulating system to simulate the Waste Heat System final circulation in the First Sleeper Railcar.

Testing shall include a functional check of all apparatus including temperature sensors and controls, and temperature and relative humidity verifications to show compliance with the specified cooling requirements with all apparatus operating at nominal voltage of 480 VAC, 3 phase, 60 Hz.

4.2.8.2 Air Balance

An air balance test and a Railcar pressurization test shall be conducted.

4.2.9 Lighting

The intensity of the lighting shall be measured in the First Sleeper Railcar and each Railcar type to determine compliance with the lighting levels required by these Specifications.

4.2.10 Clearance

Compatibility of the completed Railcars with design clearance specifications shall be demonstrated by measurement.

Truck and coupler clearances, inter-car cables and hose lengths, and operation of these components shall be checked by simulating curve and crossover conditions.

4.2.11 Wheelchair Access Provisions

The accessibility of the completed First Sleeper Railcar to wheelchair passengers shall be demonstrated. A sequence of actions shall be undertaken by a sample wheelchair passenger.

4.3 PROVISIONAL ACCEPTANCE TESTS

4.3.1 General

The tests specified in this Section shall be performed by the Contractor at Contractor's facility. The tests shall be satisfactorily completed as a condition of Final Acceptance. All tests shall be performed on all Railcars, except as noted.

4.3.2 Requirements

Each Railcar shall be jointly inspected by the Engineer and the Contractor. The Contractor shall make such adjustment, repair, or replacement as required for proper operation as required to be in compliance with the Specifications before testing is begun.

4.3.3 Frequency and Application

The following tests shall be performed by the Contractor, or under its direction:

Test	Frequency	Performed By	Reference
Functional Tests	All Systems	Contractor	4.4
Truck Clearance	All Railcars	Contractor	2.2
Coupler Height	All Railcars	Contractor	2.2
Buffer Alignment	All Railcars	Contractor	4.3.5

Test	Frequency	Performed By	Reference
Single Car Air Test	All Railcars	Contractor	4.3.4

4.3.4 Function

A complete, orderly, and comprehensive test of each Railcar system, including single car air test, shall be made to verify its proper operation. The Contractor shall develop a test check off list to be used to verify each test.

4.3.5 Miscellaneous Body Tests and Adjustments

Truck clearances, lengths, heights and locations of electrical jumpers and any other end connection shall be verified.

Coupler installation shall be verified or adjusted to proper height and level.

Buffers shall be verified for proper alignment and level.

4.3.6 Provisional Acceptance

Successful completion of all of the preceding Provisional Acceptance tests and correction of all known deficiencies by the Contractor and successful retest thereof to the extend necessary to demonstrate compliance the Specifications, shall be accomplished prior to Provisional Acceptance by PM.

4.4 FINAL ACCEPTANCE TESTS

The requirements for Final Acceptance of the Trainset will be considered met after satisfactory completion of the following tests:

4.4.1 Trainset

The Trainset shall be operationally tested prior to Final Acceptance to demonstrate the Railcars and Locomotives operate satisfactorily as a unit. This test includes running as well as static tests.

These tests shall be performed by the Contractor prior to Final Acceptance and shall include:

- <u>Braking Tests</u>

  Two series of tests shall be performed.
  - Full service brake stops
  - Emergency stops

For the first series of tests, the simulated passenger load in each Railcar shall be zero; for the second series of tests, will include a simulated passenger load. In all friction stop tests, for each run, discs shall be cooled to a maximum of 250°F as measured by thermocouple before initiation of any test. The following tests shall be performed:

- Wheel Slide

  All braking modes shall be tested.

- Pressurization Test

  One Railcar of a Trainset shall be tested to demonstrate compliance with the interior pressurization requirements.

- Power Railcar Performance

  Satisfactory operation of auxiliary power supply circuits and protective apparatus shall be verified.

- Communication System

  The complete communication system shall be tested on a one time basis for compliance with the requirements of these Specifications.

MATERIALS AND WORKMANSHIP
SECTION 5

5.1 GENERAL

5.1.1 Applicability

This Section describes materials and workmanship requirements generally applicable to the Railcars and the Locomotive modifications. These comprehensive requirements cover all areas of materials and workmanship applicable to new construction, remanufacture and modification of the Trainset components. Certain requirements of this Section will not apply if the systems, apparatus or materials described are not incorporated into the completed Trainset components.

The Contractor shall be responsible for performing all work on the Trainset components in accordance with the applicable requirements of this Section.

5.1.2 Quality

Material and workmanship shall be in accordance with the stated Specifications.

When a material or method is specified in this Section, this Section shall be applicable; however, specific requirements detailed in other sections of these Specifications take precedence over this Section.

5.1.3 Standards

In the event the Contractor elects to use the following domestic standards and specifications they shall define materials for this contract: Federal or Military Specifications or Standards, the Specifications of the Aluminum Association of America, AAR, ANSI, ASME, ASTM, FRA, IEEE, and additional requirements, as specified herein. Regarding foreign standards, the Contractor shall demonstrate the proposed standards are the equivalent of the foregoing standards and/or meet the requirements of these Specifications.

5.1.4 Marking

All materials intended for use on these Trainset components shall be marked or stored so as to be readily identifiable, and shall be adequately protected during handling and storage. Rejected material shall be clearly marked and stored in an area specifically designated for that purpose.

5.1.5 Cleaning Agents

A list of recommended cleaning agents shall be provided to PM. This information shall also be included in the maintenance documentation for the Trainset component.

5.1.6 Certificates of Compliance

Tests required by this Section shall be waived by PM if Certificates of Compliance are obtained by the Contractor in lieu thereof. Such Certificates of Compliance shall demonstrate evidence of compliance from a recognized testing facility or other entity for the material for use in an application intended by the Contractor for the Agreement.

5.2 JOINING AND FASTENING

5.2.1 Joining

5.2.1.1 General

Certain combinations of materials require particular care in joining to avoid the possibility of corrosion. Isolating and moisture-proofing materials, appropriate to the materials being joined, shall be used at all times where these combinations exist.

5.2.1.2 Joint Fitting

Joints shall be properly fitted, whether exposed or concealed. When not otherwise specified in drawings or specifications, gaps between joints shall be held to a dimension not greater than 10 percent of the thinner material being joined, or 0.03-inch, whichever is greater. Gaps shall be uniform in width. The edges of panels shall have a smooth, finished appearance.

Where excessive gaps (greater than those permitted by approved drawings or standards) are found to exist at the facing surfaces of structural bolted or riveted connections, metal shims of the same material as that of the deficient part may be used. Shims, if used, shall be permanently fastened to one of the base parts being joined.

5.2.1.3 Metal-to-Metal Connections

Where metals contact each other, the contact surfaces shall be free of dirt, grease, rust, and scale. Unless specified otherwise, the contact surfaces shall be coated with a metal based primer. Metal primer may be omitted for like-stainless steel to like-stainless steel joints.

5.2.1.4 Wood-to-Metal Connections

Where wood and ferrous metal surfaces are placed together, the wood shall be coated with aluminum paint conforming to Federal Specifications TI-P-38, and the metal shall be coated with a primer which conforms to Federal Specifications TT-P-664.

All bolts or rods passing through wood shall be coated with aluminum paint conforming to Federal Specifications T-P-38.

5.2.1.5 Wood-to-Wood Connections

Where wood and wood are placed together, both abutting surfaces shall be coated with aluminum paint conforming to Federal Specifications T-P-38.

5.2.2 FASTENERS

5.2.2.1 General

The Contractor and suppliers are responsible for selecting fastener types, Sizes, styles, lengths, materials, grades, and finishes that will meet the requirements of the specifications.

Fasteners used throughout the Railcar shall be inch standard fasteners, except that ISO Metric fasteners can be used in conformance with Section 5.2.2.2.1.

All fasteners used on this Railcar shall be specified under one of three categories: electrical and electronic, structural and safety related, or decorative. Fasteners internal to electrical or electronic components are specified in appropriate MATERIALS AND WORKMANSHIP subsections for electrical devices and wiring. All structural and safety related fasteners are specified under Structural Fasteners. Fasteners used to attach interior lining or trim and exposed to passenger view are specified under Decorative and Appearance Fasteners.

Safety related fasteners include, but are not limited to, the following: fasteners applied to trucks, bolsters, brake equipment, couplers, and power collection devices. A fastener is safety related if failures can not be tolerated, that is, if even a single fastener fails there is a possibility of brake failure, derailment, or an accident.

5.2.2.2 Threaded Fasteners

All inch-standard threaded fasteners shall conform to ANSI B1.1 Standard, Unified Inch Screw Threads, (UN and UNR Thread Form) or Industrial Fasteners Institute 1970 Fastener Standards.

Prevailing-Torque type locknuts shall be nylon insert type, ESNA or equal, conforming to IFI Fastener Standards or Military Standard MS-21044. Distorted thread locknuts shall only be used where there is insufficient clearance to install ESNA type locknuts, or where the locknut is exposed to temperatures above 200°F (93°C).

When making connections to heat producing apparatus, thermal expansion of the components shall be taken into consideration for selection of fastener materials. If the joined components are high expansion alloys such as copper or austenitic stainless steel, austenitic stainless steel fasteners shall be used. If the joined components are low expansion materials such as carbon steel or ferritic stainless steel, zinc plated carbon steel fasteners of minimum Grade 5 shall be used. Cadmium plated fasteners shall not be used to connect heat producing apparatus.

At least 1-1/2 screw threads shall be visible beyond all nuts.

5.2.2.2.1 Metric Fasteners

Specific components, control groups, or individual units that are supplied by a supplier or sub-supplier to the Contractor, may be supplied with metric fasteners to ANSI B1.13 (ISO-metric) Standards. All internal fasteners and threaded components of the approved assembly shall have ISO-metric threads. Internally, there shall be no mixing of metric and inch threaded fasteners. Each unit, component, or group assembled with or containing ISO-metric threads shall be indelibly identified, to signify that the unit was assembled using metric threaded fasteners or components. Maintenance manuals shall indicate where metric threaded fasteners were used within the unit.

5.2.2.3 Structural Fasteners

All structural fasteners shall have documentation identifying manufacturer and purchase specifications available for examination by the Contractor's QA department. This documentation shall include the fastener material or grade, and finish including plating material and specifications, when applicable. The Contractor shall hold this documentation for a period of not less than termination of the last Railcar's warranty period.

All safety related fasteners shall be manufactured, tested, and distributed in accordance with ASNE FAP-1-1990, Quality Assurance Program for Fastener Manufacturers and Distributors, including the requirements of ASME accreditation.

All structural bolts for undercar equipment shall be a minimum Grade 5 and the bolt diameter shall be no less than 3/8 inch (9.5 mm), regardless of design load. Stronger fasteners shall be used if the application requires. The mounting and attachment bolts for undercar mounted equipment and equipment support structures or brackets shall be sized to the design strengths for Grade 2 bolts and Class A nuts.

5.2.2.4 Decorative and Appearance Fasteners

All interior fasteners exposed to passengers shall be either bright or finished to match the surfaces being joined, and installed such that the fastener head is flush with the mating surface. Bright finished fasteners used for stanchions shall be austenitic grade stainless steel. Bright finished interior fasteners may be either austenitic or plated martensitic stainless steel. Self tapping screws are only permitted where they will not be removed for normal maintenance more frequently than once in five years.

All exterior fasteners visible to passengers shall be austenitic stainless steel for steel, LAHT steel, and stainless steel Railcar bodies. Exterior aluminum shall be joined by austenitic stainless steel or aluminum alloy fasteners, as appropriate to the design and appearance requirements. Fasteners used on the side sill to attach heavy equipment brackets are structural fasteners specified under the structural fasteners section.

Fasteners on access panels, plates, covers, or other components accessible by passengers shall be a tamper-resistant type.

All fasteners used to secure access covers or panels to equipment boxes or interior panels shall be made captive to the panel in which they are used. Where access for service is expected more often than every 5 years, access panels shall be equipped with quarter-turn fasteners.

5.2.2.5 Torquing

All safety related fasteners, including truck and brake equipment bolts and all fasteners exposed to fatigue loads, shall be torqued to a minimum preload equal to 75 % of their proof load. All other fasteners shall be torqued to a value appropriate to the application, so that they do not loosen in service.

5.2.2.6 Washers and Lock Washers

Washers shall be used under the heads of all bolts and under all nuts. Where high strength fasteners are applied, washers shall be hardened and comply with IFI 1970 Fastener Standards.

Lock washers, when applied, shall conform to IFI 1970 Fastener Standards. Lock washers shall not be used for fatigue applications where the fastener must be torqued and marked. If applicable, prevailing torque nuts shall be used for these applications.

Other types of washers, including Belleville washers, may be used for special applications.

5.2.2.7 Plating of Fasteners

All carbon, alloy, and martensitic steel fasteners shall be plated with cadmium or zinc, unless specifically waived.

5.2.2.8 Bolt Holes

Bolt holes shall be accurately located and aligned, and, when necessary during assembly, holes shall be reamed round to specified size in position. Bolt hole clearances shall not exceed the Industrial Fasteners Institute's requirements.

5.3 STAINLESS STEEL

5.3.1 General

Ferritic stainless steels shall be painted where exposed to passengers or the weather. Austenitic stainless steels may be unpainted. Unpainted stainless steels exposed to passengers shall be a single grade of austenitic stainless steel.

5.3.2 Ferritic Stainless Steels

When specified, ferritic stainless steel conforming to ASTM A 176 may be used for carbody structural sheeting up to 4 mm thickness.

Where ferritic stainless steels are welded to other structural steels, the less-noble steel shall be painted with weld through primer.

5.3.3 Material Certification

The Contractor shall obtain from the supplier of the stainless steel a certification indicating that the stainless steel conforms to specified requirements.

5.4 STEEL CASTINGS

5.4.1 General

New steel castings shall be suitably marked with pattern and serial numbers in a manner that will not impair their strength.

All new steel castings used in the truck structure, bolster, and center bearing arrangement shall meet AAR Specifications M-201 latest revision, Grade "B".

New steel castings used for coupler, drawbars and anchors shall meet AAR Specifications M-201, latest revision, Grade "C" quenched and tempered.

5.4.2 Quality of Structural Castings

The casting supplier shall certify to the Contractor that new structural castings meet the requirements of AAR Specifications M-201. In addition, the inspections below shall be performed and a written report of the results of the tests and inspections shall be furnished for each lot of castings produced.

5.4.2.1 Magnetic Particle Inspection

Magnetic particle inspections of castings, when accomplished, shall be conducted in accordance with ASTM E 709.

5.4.2.2 Radiographic Inspection

Radiographic inspection when accomplished shall be conducted in accordance with the requirements of ASTM Standard E 94 using reference radiographs to ASTM E 446.

Structural castings shall not exceed severity level 3 of ASIM E 446 in all critical areas of such castings and shall not exceed level 5 in all other areas of the castings.

5.4.3 Welding

Welding required on castings is allowed, provided welders are qualified to ASTM A 488.

5.5 ALUMINUM

5.5.1 General

Aluminum alloy mill products shall be identified by Unified Numbering System designations and shall conform to The Aluminum Association specifications contained in the Association's publication "Aluminum Standards and Data".

5.5.2 Fabrication and Fastening

The forming of aluminum parts; joining of parts by bolting, riveting, and welding; and the protection of contact surfaces shall, as a minimum, conform to the requirements of the Aluminum Company of America's Technical Report No. 524, "Specifications Covering Use of Aluminum in Passenger carrying Railway Trainset components", except as otherwise specified herein.

5.5.3 Protection of Contact Surface

The specific measures to be taken by the Contractor to prevent the risk of direct metal-to-metal contact and resultant possible electrolytic corrosion shall be approved and shall depend upon the determination of the most suitable method which can be adapted to the design involved. The following instructions shall be the minimum protection.

Aluminum alloy surfaces shall not be secured to or make direct metal-to-metal contact with the surfaces of dissimilar metals.

The contact surfaces of aluminum alloy with aluminum alloy shall be painted with zinc chromate primer before securing.

5.6 ELASTOMERS

5.6.1 Truck Parts

Truck bumpers and snubbers shall be made of natural rubber or synthetic elastomers. They shall be compounded to be resistant to abrasion, oil, grease, and acid.

5.7 GLAZING MATERIALS

5.7.1 Safety Glass

Safety glass shall meet the requirements under Item 1, Table 1 of the latest revision of American National Standard ANSI Z26. 1, "Safety Code for Safety Glass for Glazing Motor vehicles components Operating on Land Highways" or FRA 49CFR223 Type I or II test as appropriate for the application.

5.7.1.1 Type

All safety glass shall be of the laminated type.

5.7.1.2.1 Dome Glass

Dome glass shall be FRA type II for side-facing windows.

5.8 RUBBER FLOOR COVERING

5.8.1 General

5.8.1.1 Non-Skid Rubber

Rubber floor covering of RCA non-skid rubber, color to be selected by PM, shall be installed as non-skid treads on spiral staircases.

5.8.1.2 Stairway Treads

Interior stairway treads shall be RCA rubber with ADA required color contrasting stripe on each tread edge.

5.9 WOOD AND PANELS

5.9.1 Lumber

Lumber shall be thoroughly air seasoned or kiln dried before using. Lumber shall be free from dry rot, knots, checks, and other defects which may impair its strength and durability or mar its appearance.

5.9.2 Plymetal

The term "Plymetal" as used in the Specifications means metal-faced plywood.

5.9.3 Plywood

All plywood shall be manufactured to conform with the requirements of Grade - Structural I of the National Bureau of Standards Voluntary Product Standard (American Plywood Association) PS 1-83, and then stored under cover. Each plywood panel shall be formed from one piece. Scarf or finger jointed panels are not allowed. All plywood shall be sealed with 2 coats of an epoxy paint on all edges and cutouts as soon as possible after fabrication. All exposed edges of the panels, joints between panels, fastener heads, and openings of panels used in areas accessible to moisture shall be water-proofed and sealed with an approved coating prior to installation in the Railcar.

5.9.4 Honeycomb Panels

The term "Honeycomb Panels" as used in the Specifications refers to an assembly of honeycomb material bonded to melamine-faced metal panels or to metal panels. Honeycomb material shall be commercial grade.

5.9.5 Melamine-Faced Aluminum

Melamine-faced aluminum panels shall be constructed by laminating melamine to aluminum sheets. The melamine-impregnated papers shall be directly molded to the aluminum sheets. The aluminum sheets shall not be less than 0.081 inch in thickness when not laminated to a substrate such as plywood. Aluminum sheets shall be properly cleaned by etching, sanding, or other approved process to ensure full, permanent, adhesion.

5.10 SEAT CUSHIONS

5.10.1 General

Seat cushion fill material shall be low smoke flexible foam constructed of fire retardant materials. The thickness shall be approved during design review. The material shall have a polymerized or vulcanized homogeneous (free from foreign material), cellular structure with a porous surface and open cells. The cells shall be interconnecting and uniform in size. Cellular material may be molded in one piece or may be assembled by laminating to achieve the required thickness. Laminated cushions shall be bonded together. Cushion material shall be properly cured to prevent any objectionable odor.

5.11 SEAT UPHOLSTERY MATERIAL

5.11.1 Fabrics

5.11.1.1 General

Fabrics used for seat upholstery shall be made of woven or fabric backed vinyl, transportation grade fabrics. Specific fabrics for seating are to be selected by PM. An allowance for seating fabric not to exceed $75 per yard is included in the Specifications.

5.12 FIBERGLASS REINFORCED PLASTIC

5.12.1 General

Fiberglass reinforced plastic (FRP) shall be a glass-fiber-reinforced, laminated material, composed of a gel coated surface, fiberglass reinforcement, and a polyester resin or the FRP may be a pulltruded material without gelcoat. FRP shall withstand, without any physical deformation or structural damage, the environmental conditions in Section 2.5, and be resistant to cleaning solutions recommended by the Contractor.

5.12.2 Construction

5.12.2.1 Resin

The resin shall be of good commercial grade, thermosetting, polyester material selected to meet the physical properties of the Specifications and molding process requirements.

5.12.2.2 Reinforcement

The fiberglass reinforcement shall be mat, fabric woven roving, continuous roving, chopped spun roving, or swirl mat as required to meet the fabrication process requirements.

5.12.2.3 Gel Coat

The gel coat shall be resistant to scuffing, weather, and cleaning agents.

5.13 PIPING AND TUBING

5.13.1 General

All piping, tubing, valves, fittings, installation methods, and testing shall be in accordance with the Code for Pressure Piping, ANSI B3 1. 1. All joints shall be easily accessible.

All piping systems shall be cleaned to remove dirt, metal chips, oily contamination, and moisture. After cleaning, all piping systems shall be pressure tested. All leaks shall be repaired and the system recleaned as necessary and retested until leak-free.

Pipes must be supported throughout their length and at all connections to prevent vibration or noise and to limit stresses in the pipe. Pipes and their connections shall not interfere with the removal of other components. Pipe routing and support shall be planned and accomplished in an efficient, organized manner to keep the total length and number of fittings and bends to an minimum.

At all locations where pipe or tubing passes through holes in the floor, bulkheads, structure, or any fixed member, it shall be installed to protect against possible damage or noise due to bearing, abrasion, or Railcar dynamics-induced rattling. Clamps shall not be welded, brazed or otherwise permanently fastened to any pipe or tubing.

5.13.2 Air Piping, Tubing, and Fittings

The main reservoir pipe and brake pipe shall conform to ASTM A 53, Schedule 80 seamless pipe. Type "K" annealed copper tube per Federal Specifications WW-T-799 latest revision may also be used, provided it is installed no lower than 2 inches below the floor sheet and is protected by means of equipment or approved steel guards from any potential impact damage from rail debris, especially in the truck and outboard of the bolster areas. Where suitable protection in damage-prone areas is not possible or practical, approved steel piping sections shall be provided. The diameter of the main reservoir pipe and brake pipes shall meet the brake supplier's requirements; however, in no case shall these pipes be less than 7/8 inch O.D.

All air pipes shall be sized in accordance with the function intended and may be either ASTM A 53 schedule 80 pipe or seamless copper tubing as described previously. All joints for copper tubing shall utilize fittings of wrought copper or non-porous cast brass in accordance with ANSI Standards B16.22 and B16.88.

All hose utilized within the air system shall be in compliance with AAR Specifications M-618 latest revision. All hose fittings shall be of the reusable type.

All cut-out cocks shall be of the vented type, except where function prohibits.

Air piping on the trucks shall be 1/2 inch ASTM A 53 Schedule 80, or equal.

The use of threaded fittings is expressly prohibited.

5.13.3 Air Conditioning System Piping, Tubing, and Fittings

Air conditioning refrigerant lines and condensate drain lines shall be of seamless copper tubing, with wrought copper sweat type fittings. Joints shall be kept to a minimum and all inaccessible runs of tubing shall be without joints. Instead of elbows, tubing may be bent utilizing a bending tool designed specifically for bending of the tubing to be used.

Suction lines shall be designed and installed without traps.

Lines subject to condensation shall be insulated with an approved insulation, applied with an approved contact cement. The liquid line shall be insulated in all areas where required to provide additional mechanical or thermal protection. Insulation at all joints and fittings shall be mitered and sealed with an approved material. The insulation, adhesive, and sealant shall meet the Specifications requirements for thermal, smoke emission, and flammability performance.

All piping and pipe subassemblies shall be deburred, cleaned, dried, and capped with tight fitting plastic caps, or equal on all openings after fabrication. Caps shall remain in place until immediately prior to incorporation into the final assembly.

Vibration eliminators shall be used in piping connections to the compressor.

5.13.4 Brazing and Soldering of Piping, Tubing, and Fittings

All refrigerant piping and air system copper tubing shall be joined using silver solder. Refrigeration piping and tubing shall be internally swept with a continuous flow of a non-oxidizing gas such as dry nitrogen during brazing. Solder joints shall be wiped and have flux cleaned from tubing and fittings after soldering. After fabrication, the refrigeration and air systems shall each be cleared of all dirt and foreign matter, flushed with a degreasing agent and dried.

5.14 WIRE AND CABLE

5.14.1 General

A minimum number of wire types and sizes shall be used in each Railcar.

Selection of wire sizes and insulations shall be based on the current carrying capacity, voltage drop, mechanical strength, temperature and flexibility requirements in accordance with applicable AAR, ICEA, ASTM, and NEC. However, in no case shall the properties of the wire and cable be less than those properties delineated in the Specifications.

Only wire or cable shall be used for carrying electrical current. Where the Specifications uses wire insulation trade names, the use of equals is implied.

5.14.2 Conductors

Wiring shall be sized for the intended load, voltage drop, installation method, and applicable codes.

Maximum wire ampacities shall conform to the National Electric Code (NFPA 70) Table 31016, 90°C column for wires in raceways or conduit, and 310-17 90°C column for wires in free air except as expressly provided for the 480 volt trainline system which is rated at 120°C.

5.15 WIRING

5.15.1 General

All Railcar wiring shall be in conformance with Chapter 3 of the National Fire Protection Association's Publication NFPA No. 70, National Electric Code, and the AAR Manual of Standards, Section F S-538, "Wiring Practice and Rolling Stock Standard", except where otherwise specified. Circuit protection shall be in conformance with Chapter 2 of NFPA publication No. 70, Article 240.

5.15.2 Wire Handling

All wiring shall be performed by experienced wiring personnel using appropriate tools for stripping insulation, cutting, timing, soldering, harness making, attaching terminals, etc.

Wire shall be protected from damage during all phases of equipment manufacture. Wire shall not be walked on, dragged across sharp or abrasive objects, kinked or twisted, or otherwise mishandled. The ends of wire shall not be permitted to lay on wet floors or other damp areas where moisture may be absorbed into the conductors.

5.15.3 Wiring Layout and Installation

5.15.3.1 Wire Harness

The layout of wiring, for both Railcar and equipment, shall be designed in advance of its installation and in cooperation with the suppliers of the related equipment as may be appropriate. Where applicable, wiring shall be pre-fabricated, into standard harnesses, wrapped and tied with a high strength, waxed lacing cord designed not to invade the wire insulation or nylon wire ties. Harnesses shall be installed with identical arrangement and location in each Railcar having identical arrangements.

Harnessed wires shall not be installed in conduit.

5.15.3.2 Circuit Separation

Circuits shall be physically separated as practical to reduce the possibility of unsafe conditions, interference, or equipment damage.

5.15.3.3 Wire and Cable Runs

All undercar wiring smaller than No. 6 AWG shall be run in closed wire ducts, conduits, or open wireways. Wire and cable shall be secured within ducts or open wireways, including each entrance and exit point, to prevent chafing movement. Wire ducts and conduits shall be of water resistant construction. Permanently retained water resistant strain relief bushings, with insulated throat liners shall be used at locations where wires, cables or harnesses enter or exit conduit, ducts, apparatus and equipment enclosures.

Any wiring run through the floor shall be run in ducts or conduit.

Cables shall be laid in place with sufficient slack at the bends so that cables will clear the inside bend surface of the wireway/wire duct.

All wire and cable shall be free of kinks, insulation damage, insulation abrasions, and nicked strands. Wire installation shall not be subject to accumulations of water, oil, or other foreign matter.

Wires or cables shall not pass through or over the battery compartment and shall not pass over heat generating equipment even if the wires or cables are in conduit unless the battery compartment or heat generating equipment is properly insulated from the conduit so that the conduit is not subject to heat absorption from the equipment.

5.15.3.3.1 Wire Securement and Termination

All wiring shall be secured and protected against movement, chafing, and any contact with conductive, sharp, or abrasive objects.

All wiring shall be located and secured such that normal equipment motions, maintenance access, heat sources, and the environment do not damage or unreasonably reduce the life of the wiring.

Junction boxes, with terminal boards, shall be used, as required, for wire terminations. Harness connections to the boxes, as well as internal wiring to terminal boards, shall be accomplished in accordance with Contractor's normal practice. Exterior junction boxes shall be weathertight.

In cases where it is necessary to anchor wires or cables to metallic parts of the Railcar, cleats or stainless steel bottle clamps shall be used. Wires and cables shall not be allowed to chafe or rub against any part of the Railcar or each other under any circumstances.

Wire and cable dress shall allow for sufficient slack at equipment terminals to provide for movements induced by shock and vibration, equipment shifting, alignment, cover removal and component replacement.

5.15.4 Solder

Solder shall be in accordance with ASTM B 32, Grade 60B. A flux of non-corrosive type shall be applied immediately before soldering.

5.15.5 Tape

Electrical tape shall be polyvinyl chloride in accordance with AAR Standard S-540 of Section F of the AAR Manual Standards and Recommended Practices, or equivalent approved railway practice. Electrical tape shall meet or exceed the voltage rating of wire where the tape is applied.

5.16 WIRE AND CABLE CONNECTIONS

5.16.1 General

All equipment enclosures and junction boxes, except primary power circuits, shall be fitted with terminal boards or connectors. Primary power circuits shall be fitted with compression terminals and knuckle joint connectors as may be required herein.

5.16.2 Wire Terminations

Terminals and connections used throughout the Railcar shall be the mechanical, solderless, crimp type made by AMP Incorporated or other manufacturer with a comprehensive line of terminals, connector pins, and application tools available.

Terminals and connections shall be attached to the wiring with proper crimping tools. The terminals used on conductors of size No. 10 AWG or smaller shall be of the type which securely grips and holds the insulation of the conductor. Spade and hook-type terminals shall not be used.

Conductors subject to motion relative to the terminal shall be protected by suitable means to prevent breakage of the conductor at or near the terminal. Sufficient slack shall be provided in all wires and cables to prevent breaking or pulling out of bushings and terminals.

5.16.3 Power Cable Terminations

Power cables shall be terminated with a compression terminal. Sufficient cable slack shall be provided to preclude breaking or pull-out from bushings or terminals. Cable conductors shall be clean prior to installation of terminals. Swaging tools shall be of a type that ensures complete swaging in every case.

5.13.4 Quick-Disconnect Terminals

Quick-disconnect terminals may be installed to facilitate maintenance and inspection. They shall provide positive engagement. All terminals shall be provided with insulation equal to that of the wire. No "push-to-fit" (FASTON) type terminals will be permitted.

5.16.5 Grounding Return Connections

5.16.5.1 Grounding

Grounding connections to the Railcar body and equipment shall be made through copper pads of an adequate area, attached to the respective Railcar body and piece of equipment. All ground pads shall be visible and accessible for inspection and troubleshooting. The ground connections shall be attached by a bolt, washer, and nut intended for the purpose.

The Contractor shall develop a complete grounding scheme. Low voltage and high voltage circuits shall not be grounded to the same ground.

5.16.5.2 Bonding

All grounding and bonding jumpers and straps shall be sized to handle fault current.

5.16.6 Wire Splicing

Splicing of conductors shall be avoided and shall be permitted only on a case-by-case basis. Splicing of conductors in conduit will not be permitted. In the event a splice is made, it shall be in a junction box and the spliced joint shall be mechanically as strong and have the same conductivity as any other part of the conductor. The splice shall be an insulated permanent crimp splice. All splices shall be insulated with a self sealing, weathertight, seamless shrink tubing. The outside diameter of the spliced portion of the cable after the insulation is applied shall not exceed the outside diameter of the unspliced portion by more than 40%.

5.17 CONDUIT

5.17.1 General

All conduit and conduit couplings shall be of an ANSI approved type. With the exception of truck areas, all conduit shall be of Aluminum Association's recommended aluminum alloy or galvanized steel. Conduit installed on the trucks or in underfloor areas over the trucks shall be standard weight, galvanized steel with threaded fittings. All conduit ends shall be deburred inside and out to remove sharp edges and all pieces shall be blown out with compressed air and cleaned before installation to remove filings and other foreign material.

5.17.2 Size and Fill

Conduit shall be sized such that the sum of the cross-sectional areas of the conductors and their insulation does not exceed 40% of the cross-sectional area of the conduit for 3 or more conductors. For 2 conductors, a limit of 31 % shall be used, while for a single conductor, a limit of 53 % will be permitted. Where conduit having a length not exceeding 24 inches without bends of more than 15° are used between enclosures, a maximum fill of 60% will be permitted.

5.18 WELDING AND BRAZING

5.18.1 General

The Contractor shall be responsible for the quality of its own welding and brazing and that done by its Suppliers and Subcontractors.

5.18.2 Structural

All structural welding practices not specifically covered in other Sections of the Specifications shall be in accordance with requirements of the American Welding Society AWS-D1.1, "Structural Welding Code, Steel"; AWS-D1.2, "Structural Welding Code, Aluminum", AWSDI.3, "Structural Welding Code, Sheet Steel"; and the AWS Handbook. Requirements for dynamically loaded structures shall be applied.

5.18.3 Welder Qualification

Welders employed in the making of welds on structures or products built under the Specifications shall make only those welds for which they have been qualified.

5.18.4 Warpage

All parts joined by welding shall be supported and held in their proper position during the welding process. The method of depositing weld metal shall be chosen to minimize warpage. Flanges may be stabilized during weld fabrication with bars temporarily tack-welded in place, if this and subsequent removal of the temporary bars does not impair the strength of the weld-fabricated assembly.

5.18.5 Weld Penetration

Unless otherwise specified or prohibited, complete joint penetration welds are required for all structural butt, corner, and tee-joint welds. Partial penetration welds may be made only with approval of the Contractor's formal detailed request. Where partial penetration structural welds are proposed, the Contractor shall provide design calculations supporting the penetration used and shall conduct tests to prove that production welding achieves this required penetration with a margin of safety suited to the design application.

5.18.6 Inspection

The Contractor shall inspect all structural welds in accordance with AWS D1.1. In addition to visual inspection specified for all welds, nondestructive surface inspection (dye penetrant or magnetic particle methods, as appropriate) may be used.

5.18.7 Weld Cleaning Requirements

All welds exposed to passengers or on sliding contact surfaces of truck frames and bolsters shall be completely cleaned of all spatter.

5.18.8 Welding Rod or Wire

All welding rod or wire shall be purchased to AWS Specifications.

The material shall be stored in accordance with recommendations of the AWS "Structural Welding Code" to protect it from damage, and allow for easy identification. Material shall be issued and handled in such a way as to prevent it from being mixed with that of another specification.

5.18.9 Torch Brazing

All brazing, defined as heating above 840°F, shall follow the recommendations contained in the AWS Welding Handbook, Volume 2, latest issue.

The appearance of brazed joints shall be in accordance with AWS quality standards.

5.18.10 Torch Soldering

All structural (not electrical) soldering, defined as heating below 840°F, shall follow the recommendations contained in the AWS Welding Handbook, Volume 2, latest issue.

5.19 PAINTS AND COATINGS

5.19.1 General

The exterior portion of the Railcar body receiving paint shall be painted as required by the Specifications and in accordance with the to be specified color scheme, lettering and numbering. Austenitic stainless steel portions of the Railcar body shall not be painted, unless otherwise specified by PM for cosmetic reasons. Where stainless steel is painted, surfaces shall be properly prepared to ensure adhesion.

5.19.2 Materials and Preparation

Preparation of the painted surface and application of painting materials for brushing or spraying shall be in accordance with the paint supplier's recommendations. All paint materials shall be used at the consistency recommended by the paint supplier. If thinners are necessary, they shall be approved by the paint manufacturer and shall be used only to the extent recommended. Painting shall be done by experienced labor, using proper equipment under competent supervision.

All paint and filler materials which are to be superimposed to form a finish shall be mutually compatible.

5.19.3 Exterior Painting

Before painting any Railcar surface that is exposed to view, dents, gashes, nicks, roughness, or other surface imperfections or depressions shall be removed so far as possible by straightening and shall be prepared to receive the filler material. These surfaces shall be wash primed following straightening. Any remaining dents or other surface imperfections shall then be filled with an epoxy-based filler and sanded smooth. The maximum allowable filler thickness shall be as recommended by the filler manufacturer for the environment and service to which it is to be exposed.

Paint shall be uniformly applied over all surfaces to be covered and shall be free from runs, sags, or other application defects. Painting shall be done in a clean, dry atmosphere at an ambient temperature as recommended by the paint manufacturer.

Exterior paint system shall match paint scheme and graphics as specified by owner.

Exterior LAHT skin material shall be sandblasted and given (1) coat of weld through primer, then exterior shall be sanded and (1) coat of DuPont Imron 5000 compatible primer applied. After sanding a final coat of DuPont Imron 5000 shall be applied in the paint scheme selected by PM.

The same process shall be followed for exterior skin material of FRP except that the FRP shall neither be sandblasted nor primed with weldthrough primer.

5.19.4 Apparatus and Underfloor Equipment

All underfloor apparatus (control boxes, junction boxes, brake valves, and other equipment as specified) shall be primed and painted in accordance with a color scheme selected by PM.

The exterior surfaces of undercar equipment enclosures and apparatus made from carbon steel shall be prepared, primed, and painted as specified in Section 5.19.3.

Parts of undercar equipment enclosures made from non-metals shall be painted in accordance with the above requirements for metal portions except that the paint system shall be compatible with the material to be coated.

5.19.5 Painting Restrictions

Any equipment or parts of equipment which would be damaged or suffer impaired operation from painting shall not be painted and shall be corrosion resistant.

The following items shall not be painted:

- Wire and cable,
- Heat transfer surfaces,
- Electrical insulators,

- Elastomeric portions of air and refrigerant lines, and
- Grounding pads.

The following truck-related items shall not be painted:

- Wheels,
- Axles,
- Elastomeric parts,
- Grease fittings,
- Linkages,
- Threaded parts used for adjustments, and
- Wearing surfaces.

5.19.6 Interior Painting

All interior panel surfaces which are selected by PM to be painted shall be cleaned, sanded, fulled as necessary, primed and finish painted with a polyurethane paint as selected by PM. All cleaners, fillers, primers and thinners shall be from a compatible system by the paint manufacturer and shall be applied according to manufacturer's specifications.

5.19.7 Corrosion Protection

Concealed surfaces capable of rusting or oxidation shall be properly cleaned, then primed and painted with a finish coat of paint.

Where arc welding is performed on joints between stainless steel and other materials, the joint shall be de-scaled, cleaned, then painted.

5.19.8 Trucks

Before rebuild, the trucks shall be cleaned with a pressure washer and sandblasted. All truck components not listed shall then be sprayed with one (1) light coat of paint and air dried.

5.20 FLAMMABILITY AND SMOKE EMISSION RECOMMENDATIONS

5.20.1 General

The overall design intent of the passenger Railcars shall be to reduce the flammability, hazardous smoke emissions and total combustible material content of the Railcars in order to promote passenger safety in the event of an accident or fire. The FTA published "Recommended Fire Safety Practices for Rail Transit Materials Selection - January 1989" in the Federal Register, Volume 54, No. 10, January 17, 1989. While these recommended practices apply to transit vehicles and in large part were developed for vehicles operating for extended periods or time on underground right of way, they have been widely adopted in the

U.S. Rail industry as guidelines for reducing the hazards of fire and smoke to passengers and generally represent the highest attainable standards.

The materials as selected by the Contractor for the following items shall be in conformance with the above referenced FTA "Recommended Practices":

1. Electrical wiring insulation
2. Plymetal wall and floor panels
3. Seat cushion foam and cushion backing/pan
4. Plastic laminate finished surfaces and substrates
5. FRP panels and formed structures
6. Corian or equal counter tops and sinks
7. Glazing retention strips and sealants
8. Loncoin or equal "coined" flooring
9. RCA or equal stair treads and edging
10. Cabinetry substrates
11. Door substrates
12. Lighting and air conditioning diffusers and valances
13. Acoustical and thermal insulation materials
14. Bed mattresses
15. Lexan or equivalent polycarbonate glazing material

Contractor shall obtain from the manufacturer (or by independent test) Certificates of Conformance for the above items and shall retain the same in its possession and shall provide a copy of the same to PM.

Contractor shall advise PM of the likely conformance or non-conformance of materials PM shall select for finish. Such materials may include upholstery fabrics, curtain fabrics, wall coverings, cabinet finishes, carpet and other materials requested by PM. In the event that a Certificate of Compliance cannot be secured from the manufacturer of the item selected by PM, then PM may, at its option and expense, elect to have the material tested independently for conformance. If PM shall so direct Contractor in writing, Contractor shall order and install materials which do not conform to the above recommended practices.

All combustible material used in the construction of the Railcar shall satisfy the flammability and smoke emission requirements cited in this Section.

Authority approved, independent laboratory test results indicating successful compliance with these requirements are required for all materials. Test reports older than three (3) years shall be generally acceptable but shall be reviewed by PM on a case-by-case basis and approved, if appropriate, for the intended application. The Contractor shall be responsible for complete conformance with these standards for itself and its subcontractors and suppliers.

As a minimum, all materials used in the construction of the Railcar shall meet the requirements of this Section and the Urban Mass Transportation Administrations "Recommended Fire Safety Practices for Rail Transit Materials Selection - January 1989" as it appeared in the Federal Register, Volume. 54, No. 10 of January 17, 1989, pages 1837 through 1840 inclusive.

5.20.2 Electrical Fire Safety

Electrical equipment shall conform to NFPA 130, Section 4-3, except where more restrictive requirements are imposed by the Specifications.

5.21 AIR FILTERS

5.21.1 HVAC and Equipment Ventilation Filters

Filters shall be selected in accordance with the manufacturer's recommendations for the specific equipment involved. Filters shall be the throw-away type, except reusable filters may be approved for specific applications where throw-away filters are not available. Filters shall be designed to meet the performance requirements of each installation. All filters shall be freely accessible for maintenance.

5.21.2 High Pressure Air Filters

Air filter assemblies with replaceable filter elements shall be provided in the air line that connects each subsystem to the air supply system. The air filter filtering capability, flow rate capability, and overall size shall be appropriate for the application so that the filter replacement interval is greater than six (6) months. It shall be possible to gain access to the filter element for replacement without requiring any pipe fittings to be disconnected or loosened.

5.21.3 Low Pressure Air Filters

Replaceable media type filters shall use resin-bound, spun-glass fiber materials.

COUPLER, DRAFT GEAR AND TRAINLINE CONNECTIONS
SECTION 6

6.1 GENERAL

The remanufactured Railcars shall be is equipped with Type H tightlock couplers, twin cushion draft gears, and AAR No. 6 operating rod mechanisms.

Electrical and pneumatic connections are provided for multiple Railcars operation.

6.2 COUPLERS

6.2.1 Coupler

Couplers shall be removed from the Railcars and inspected in accordance with paragraph 4.0 of AAR Specifications M-206B.

Coupler bodies and parts defective, cracked, broken or worn beyond limits shall be replaced as specified by paragraph 5.0 of AAR Specifications M-206B. New couplers and parts in accordance with AAR Specifications M-206 or reconditioned material in accordance with AAR Specifications M-206A shall be provided.

Lubrication of new and reconditioned couplers shall be in accordance with paragraph 6.0 of AAR Specifications M-206B.

6.2.2 Coupler Operating Rod

Coupler operating rods shall be repaired or renewed for operation in accordance with paragraph. of AAR Specifications M-206B .

6.3 DRAFT GEAR AND YOKE

6.3.1 Draft Gear

Draft gear units shall be sandblasted, inspected and refurbished as necessary in accordance with the draft gear manufacturer's maintenance instructions. All draft gear wear plates and rubber pads shall be replace with new material to manufacturer's specifications.

6.3.2 Yoke

Yokes shall be inspected and reconditioned in accordance with the following procedures:

1. Yokes shall not be reconditioned except for the replacement of bushings and the application of shims to worn yoke pockets where required.

2. All yoke bushings shall be renewed. Where bushing holes are distorted or worn to cause improper fit of bushings, the yoke shall be scrapped.

3. Measure length of yoke pocket. If worn oversize 1/8 inch or greater, original length shall be restored by application of a shim of proper thickness. Shim shall be welded only along each side and not welded across the top and bottom.

4. Yokes which are cracked (with the exception of cracks in limited areas specifically permitted by the yoke manufacturer) shall be scrapped.

5. Yokes worn 3/16 inch or more in the strap area shall be scrapped.

6.3.3 Yoke Pins

New yoke pins shall be applied.

6.4 DRAFT GEAR POCKET

Draft gear pockets shall be inspected and, where worn, shall be restored to new dimension by applying shims to the draft stops. Minimum shim thickness shall be 1/8 inch. Stops shall be square within 1/16 inch.

Yoke support wear plates worn more than 1/16 inch from original thickness shall be replaced. Clearance with yokes and gears shall be checked to ensure free operation.

6.5 COUPLER CARRIER

Coupler carriers shall be disassembled and carriers, wear plates, stop blocks and springs inspected for wear and damage, and restored as necessary. Wear plates shall be replaced if worn or gouged to less than 1/8 inch thick. Coupler carriers shall have a minimum travel of 2¼ inch below coupler center line and shall maintain the coupler in a level position.

6.6 PNEUMATIC TRAINLINE CONNECTIONS

Locking type angle cocks shall be provided in the brake pipe at both ends of the Railcar. Existing angle cocks shall be repaired and reused, or renewed. Angle cocks shall be replaced by the Contractor as necessary. Angle cocks shall be accessible and located in accordance with AAR standards.

Locking type cut-out cocks shall be provided in the main reservoir equalizing pipe at both ends of the Railcar. Existing cut-out cocks shall be renewed.

New No. 87101 brake pipe hoses dated less than one year old, upon Delivery to PM, shall be applied at each end of the car.

New No. 562651 main reservoir equalizing pipe hoses dated less than one (1) year old when delivered to PM shall be applied at each end of the Railcar.

Dummy couplings and chain assemblies for air connections shall be provided at each end of the Railcar. The existing dummy coupling and chain assemblies shall be repaired or renewed.

Air hoses shall be located to avoid fouling when Railcars are coupled on straight or curved track.

6.7 ELECTRICAL TRAINLINE CONNECTIONS

Any existing control trainline receptacles and wiring shall be removed and replaced with a new 27-point Amtrak compatible communication trainline.

6.7.1 Trainline Receptacles and Jumpers

There shall be four (4) new 27-point trainline receptacles per Railcar, one on each side of the coupler pocket at each end of the Railcar.

The trainline receptacles shall be compatible with receptacles used on Amtrak rolling stock. The length of the cable provided with each receptacle shall be sufficient to permit proper termination in the trainline junction box.

6.7.2 Trainline Junction Boxes

A trainline junction box shall be provided below the Railcar floor at each end of the Railcar. Each box shall have, as a minimum, sufficient terminal studs to terminate all of the trainline circuits.

6.7.3 Trainline Wiring

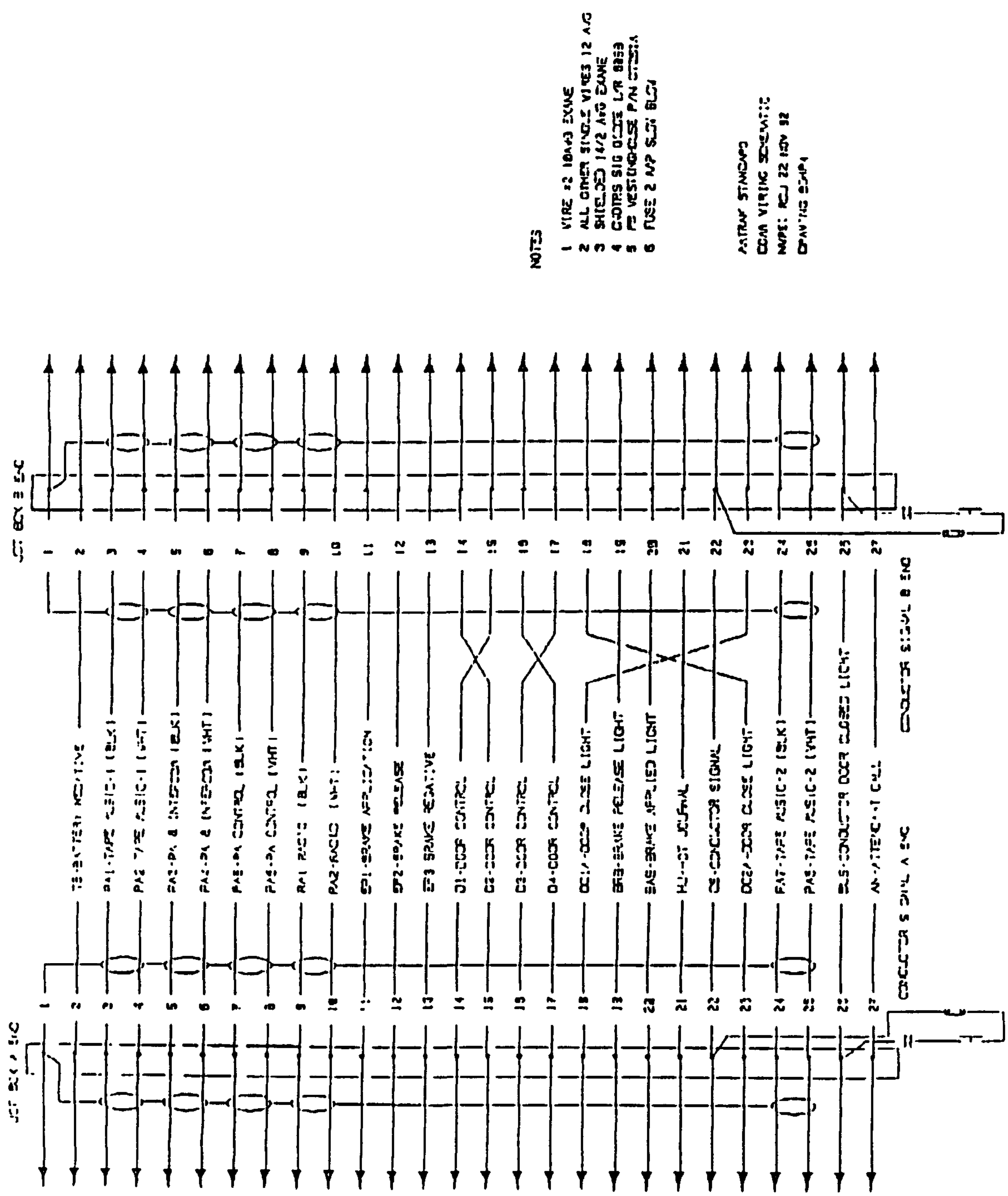
All pins of each receptacle shall be wired to terminations in the Trainline Junction Boxes. All of these circuits shall be wired between the Trainline Junction Boxes at opposite ends of the Railcar.

The wire sizes in the trainline between junction boxes shall be as required by the Amtrak specification.

The wiring or the Trainline receptacles shall be in accordance with the Amtrak Standard Communications Wiring Schematic Drawing BDHP4 dated November 22, 1994 which is Appendix A to this Section 6.

APPENDIX A to SECTION 6

AMTRAK STANDARD COMMUNICATION WIRING SCHEMATIC
DRAWING BDHP 4
November 22, 1994



TRUCKS
SECTION 7

7.1 GENERAL

The Railcars are equipped with four-wheel drop equalizer inside swing hanger trucks having helical equalizer and bolster springs. Wheels are 36 inches in diameter, and journal size shall be 6 inches x 11 inches. These trucks are disc brake equipped.

All Railcars purchased by Contractor are equipped with trucks having cast steel truck frames and bolsters. The trucks shall be given a thorough general in-kind repair which shall restore the trucks to like new condition in accordance with the detailed procedures set forth herein. Service life and performance after this general repair shall be equal to that obtained from a new truck.

The repairs addressed in this section shall be accomplished in accordance with the detailed procedures set forth herein and, where applicable, to the requirements and procedures set forth in the following Amtrak Standard Maintenance Procedures (SMP).

Components	Amtrak SMP
Railcar Trucks	Heavy Truck Overhaul Procedures for Passenger Cars SMP 46617
Passenger Car Trucks Equalizing Gear	Reclamation SMP 46603
Cross Bars and Swing Hangars	Reclamation SMP 46605
Equalizer Spring Seats	Repair and Refurbishment SMP 48001
Truck Frames and Bolsters	Welding Repair SMP 48001

In the event of a conflict between the detailed procedures described in the following paragraphs and those of the applicable Amtrak Standard Maintenance Procedures, the procedures of the Amtrak SMP shall govern.

7.2 TRUCK DISASSEMBLY AND DISPOSITION OF COMPONENTS

After removal from the Railcars, trucks shall be completely dismantled and stripped of all components. Components shall be cleaned and inspected for wear and/or defects. All wear plates and bushings shall be removed. After cleaning, testing and gauging, those components found to be without defects shall be reused without further repair.

After cleaning, testing and gauging, those components found to have repairable defects and not worn beyond reclamation limits shall be restored to like new condition and reused.

Those components found to have non-repairable defects or to be worn beyond reclamation limits shall be scrapped and shall be replaced with new material. All new components shall conform to the applicable AAR Specifications applicable Amtrak SMP, or the Specifications. New components shall be interchangeable with existing components.

Service and reclamation limits, methods, procedures and materials of repair, and methods and procedures of testing and gauging shall be:

- As prescribed by OEM Recommendations
- As prescribed by the Specifications
- As prescribed by the applicable Amtrak SMP
- As prescribed by the AAR Manual of Standards and Recommended Practices

7.3 TRUCK FRAME

Truck frames shall be cleaned to bare by power washing and light sandblasting. Particular care shall be taken to remove all components which may be damaged by cleaning before the cleaning operation.

Truck frames shall be inspected for cracks using the Magnaflux method in critical areas, or by other suitable means. When defects are located, the Contractor shall effect repairs.

Truck frames shall be trammed and gauged for diagonal distortion, parallelism and perpendicular of pedestal jaws and pedestal lateral and longitudinal spacing. Diagonal distortion between pedestal jaws shall not exceed 1/8 inch.

Bushing, bolt or rivet holes which are worn oversize shall be built up by welding in accordance with Section 7.5 and shall be redrilled to drawing dimensions.

Worn finished surfaces shall be built up by welding in accordance with Section 7.5 and remachined.

Unfinished surfaces worn more than 1/8 inch below original contour shall be built up by welding in accordance with Section 7.5 and ground to original contour.

All bushings shall be renewed with like material. Bushings shall be a press fit in the frame.

All wear plates and liners shall be a pre-hardened manganese steel applied as prescribed by the truck manufacturer's drawings. Welding shall be in accordance with Section 5.23. Pedestal leg liner spacing shall be 13-3/8 inches ± 1/32 inch.

7.4 TRUCK BOLSTER AND SPRING PLANK

Truck bolsters and spring planks shall be cleaned to bare metal. Particular care shall be taken to remove all components including elastomeric stops, which may be damaged by cleaning before the cleaning operation.

Truck bolsters and spring planks shall be inspected for cracks using the Magnaflux method, or by other suitable means. When defects are located, the Contractor shall correct same.

Spring pockets and connection points for vertical shock absorbers, bolster anchor rods, and spring plank stabilizer rods shall be inspected and, where required, shall be restored to drawing dimensions by weld build-up.

Bushing, bolt or rivet holes which are worn oversize shall be built up by welding in accordance with Section 7.5 and shall be drilled to drawing dimensions.

All bushings shall be renewed with like material. Bushings shall be a press fit in the bolster.

Center plate liners shall be renewed. If the bolster casting is worn at the center plate, it shall be restored to drawing dimension by weld build up in accordance with Section 7.5. Liners shall fit tightly; it shall not be possible to insert a 0.010' feeler between liner and casting. Liners shall be secured by ¼-inch fillet welds 1 inch long, on 4 inch centers.

7.5 WELD REPAIR OF TRUCK BOLSTERS AND SPRING PLANKS

The following procedure shall be followed for weld repair of cast truck frames and bolsters.

The weldment shall be prepared by chipping, grinding, flame scarfing or burning and as follows:

- If the area involved extends through the section, a single "V" joint is recommended.
- A back-up strip (1/4-inch minimum thickness) shall be used if the root opening is greater than 1/4-inch.

- The prepared weldment and immediately adjacent area shall be free from scale, off, dirt and other extraneous matter.

Welding shall be performed with low-hydrogen, lime-coated electrodes conforming to AWS E8018-C1.

Welding shall be performed at ordinary room temperature, but at not less than 60°F. Areas which are to be welded shall be locally preheated to a temperature range of 250°F minimum to 500°F maximum as gauged with temperature indicating crayons (or pyrometer). Preheat 4-inches each side and beyond crack preparation. The temperature in the affected area shall not drop below 100°F during welding.

Each pass shall be thoroughly cleaned of slag before the next pass is made.

Interpass temperatures in excess of 750°F shall not be permitted.

Rapid cooling of any pass or completed weldment shall not be permitted.

Adequate excess weld metal shall be applied in order that the finished weldment may be ground or chipped flush with the base metal line with no discontinuity.

Undercutting, porosity greater than 0.010-inch and visible surface inclusions or slag pockets shall not be permitted.

If weldment extends through the section, with or without a back-up strip, the root of the weld shall be chipped, ground or "scarfed" clean, thoroughly inspected and back welded from the root side.

The procedure detailed herein shall also apply to the welding of the root side.

In extreme cases, where the root or back side of the weldment cannot be finished, a thorough inspection for undercutting, which may detract from serviceability, shall be made.

Upon completion of weld, a dye penetrant check shall be made to insure that no further cracks exist.

If weld repairs are performed at several locations on a truck frame or bolster with a total weld length of more than 12 inches or if a single location greater than 12 inches in any dimension is weld repaired, that truck frame or bolster shall be stress relieved in a furnace. The stress relief in a furnace shall be performed between 1075°F and 1150°F for one hour per inch of thickness or fraction thereof and the piece shall be allowed to cool in still air. Single small areas may be stress relieved by torch heating followed by cooling in still air.

7.6 BOLSTER ANCHOR AND SPRING PLANK STABILIZER ASSEMBLIES

All components of the bolster anchor assemblies shall be inspected for wear and damage. Damaged parts shall be replaced, except that anchor bolts with thread damage only shall be rechased. All elastomeric pads, slotted nuts and cotter pins shall be replaced. Anchor rod and stabilizer bolts and sleeves shall be replaced as necessary.

Cracked or damaged carbody mounted anchor rod brackets shall be repaired by grinding, welding, straightening and the application of doubling plates as required. Any oversized anchor rod mounting holes shall be welded and ground to restore proper dimensions.

7.7 SHOCK ABSORBERS

Vertical shock absorbers shall be renewed with hydraulic dampers, the damping rate of which shall be determined by Contractor after consideration of carbody weight and optimal damping rate.

7.8 EQUALIZERS

Equalizers shall be inspected and reclaimed in accordance with the following procedures:

7.8.1 Inspection

Sandblast entire equalizer. Visually inspect for cracks, gouges, and wear. (Limits of wear given under Section 7.8.3.) Magnetic particle test entire equalizer for cracks.

7.8.2 Repair

Equalizers which are worn but within the limits of wear given under Section 7.8.3 may be reapplied after worn areas, indentations, scars, and corrosion have been ground out within the permitted limits. Edges shall be ground to at least a 3/16-inch smooth radius and all ground areas blended so as to leave no abrupt change in section. All grinding shall be done parallel (and not transverse) to the equalizer. Care must be taken to avoid frictional discoloration of the surface during grinding.

Equalizer which exceed the limits of wear listed in Section 7.8.3 shall be reclaimed by welding in accordance with the criteria given in Section 7.8.4.

7.8.3 Limits of Wear

Equalizers worn within the limits listed in this Section shall be repaired by grinding in accordance with Section 7.8.2. Equalizers worn in excess of these limits may be repaired by welding if the condemning limits for welding listed in Section 7.8.4 are not exceeded.

- Indentations, scars, corrosion, etc., in any portion of the equalizer up to 3/32-inch in depth and less than 6-inches in length or width.

- Wear on either vertical surface of equalizer foot less than 1/8-inch, or a total of 1/8-inch on both sides.

- Wear less than 1/8-inch on foot surface. Wear greater than 1/8-inch requires the foot to be renewed.

- Wear less than 3/32-inch on either side of equalizer where it has contacted the pedestal or less than 3/32-inch total for both sides.

- Wear under spring seat less than 3/32-inch.

7.8.4 Reclamation by Welding

The procedure listed in this Section supplements the general welding practice described elsewhere in the Specifications and shall be followed for weld repair of equalizer beams. Equalizers which cannot be reclaimed in accordance with the procedure shall be scrapped and replaced. Cracked equalizers shall be scrapped. No welding of cracks or fractures in any part of the equalizers shall be permitted. Where worn, equalizers shall be restored to original dimensions under the procedures, subject to the restrictions in item 4 of Section 7.8.4.2. Equalizers which can not be reclaimed by grinding or welding shall be scrapped and renewed.

The Contractor shall determine the material from which the equalizers are manufactured. Weld restoration shall be by the manual electric arc process using electrodes suitable for the equalizer material.

7.8.4.1 Qualifications

Equalizer welding shall be performed by welders who have been qualified according to Section IX of the ASME Boiler and Pressure Vessel Code to positions 2F and 1G.

7.8.4.2 Procedures

1. Surfaces to be welded shall be thoroughly cleaned before welding.

2. Prior to welding, equalizers shall be preheated to 400°-500°F and shall not be allowed to cool below 400°F during welding.

3. All worn areas shall be filled by running weld bead parallel (and not transverse) to equalizer wherever possible. Extreme care shall be taken not to arc-bum any part of the equalizer.

4. Weld buildup shall not be greater than 1/4-inch to restore original dimensions. Where welding is required on both sides of the equalizer, the total built-up on both sides shall not exceed 1/4 inch to restore original dimensions.

5. Finish all welded surfaces by grinding or machining, making certain that all scars and undercutting have been removed. All edges shall be rounded leaving a smooth radius. Finish grinding shall be parallel to the section and care shall be taken to prevent frictional discoloration of the surface.

6. After welding, the equalizers shall be normalized and tempered. The Contractor shall develop normalizing and tempering procedures (temperature-time) suitable to the equalizer material.

7. During heating operations, initial furnace temperature shall not exceed 700°F, and equalizers shall be heated at a rate not exceeding 500°F per hour. After heating and holding, equalizers shall be removed from the furnace and cooled to room temperature in still air. When heating or cooling equalizers, they shall not be stacked on top of one another and shall be properly supported so as to allow uniform heating and cooling without distortion.

8. Equalizers shall be Brinell hardness tested after heat treatment. Hardness range is to be BHN 229-277.

9. Equalizers shall be magnetic particle tested after heat treatment.

7.9 EQUALIZER SPRING SEATS

Equalizer spring seats shall be inspected for wear and damage. Equalizer spring seats reapplied to each truck shall be chocked to insure that dimensions between spring seat surfaces and equalizer beam seat surfaces are within 1/16-inch of each other. Worn spring seats shall be rebuilt. New equalizer spring seats shall be applied where damage and/or severe wear has occurred.

7.10 SPRINGS

Since significant weight differences among the Railcars, even among Railcars of the same type, is anticipated, comprehensive and specific weight analyses shall be conducted by the Contractor to establish the Bolster Spring and Equalizer Spring requirements in the various Railcar applications.

Based on the Railcar weights, coil spring test loads, test weights and tolerances shall be established.

The new spring data shall be identified and recorded for each spring in each Railcar application and shall include the following:

Diameter of Bar
Outside Diameter of Coil
Length of Bar-Blunt
Tapered Length of Bar
Height Solid
Load Solid
Working Height
Normal Capacity
Free Height
Normal Weight
Direction
Coiling
Material

All springs shall be manufactured in accordance with AAR Specifications M-114 (latest revision in effect as of the date of signing the Agreement). Spring ends are to be closed and ground parallel and at right angles to the axis of the spring to provide a uniform bearing surface of at least quarters of the circumference. New springs shall conform to the New Spring Data, and shall be tested according to the Spring Test Data.

7.11 SWING HANGERS AND CROSS BARS

7.11.1 Inspection

Sandblast swing hangers and cross bars. Visually inspect for cracks, gouges and wear. (Limits of wear given under Section 7.11.3.) Magnetic particle test swing hangers and cross bars for cracks.

7.11.2 Repair

Swing hangers and cross bars which are worn but within the limits of wear given under Section 7.11.3 may be reapplied after worn areas, indentations, scars, corrosion, etc. have been ground out within the permitted limits. Edges shall be ground to at least a 3/16 inch smooth radius and all ground areas blended so as to leave no abrupt change in section. All grinding shall be done parallel (and not transverse) to the piece. Care must be taken to avoid frictional discoloration of the surface during grinding.

Swing hangers and cross bars which exceed the limits of wear listed in Section 7.11.3 may be reclaimed by welding in accordance with the criteria given in Section 7.11.4.

Swing hanger bushings shall be renewed with case-hardened material. Bushings shall be a press fit in the hanger.

7.11.3 Limits of Wear

Swing hangers and cross keys worn within the limits listed below shall be repaired by grinding in accordance with Section 7.11.2. Swing hangers and cross keys worn in excess of these limits may be repaired by welding if the condemning limits for welding listed in Section 7.11.4 are not exceeded.

- Indentations, scars, corrosion, etc. up to 1/16 inch in depth and less than 6 inches in length.

- Wear on any surface less than 3/32 inch, or a total of 1/8 inch on opposite sides.

7.11.4 Reclamation by Welding

The procedure listed in this Section supplements the general welding practice described in Section 5.23 and shall be followed for weld repair of swing hangers and cross keys. Swing hangers and cross keys which cannot be reclaimed in accordance with the procedure shall be scrapped and replaced. Cracked swing hangers and cross keys shall be scrapped. No welding of cracks or fractures in any part of these pieces shall be permitted. Where worn, swing hangers and cross keys shall be restored to original dimensions as described in the procedures, subject to the restrictions in item 4 of Section 7.11.4.2. Swing hangers and cross keys which cannot be reclaimed by grinding or welding shall be scrapped and replaced.

The Contractor shall determine the material from which the swing hangers and cross keys were manufactured. Weld restoration shall be by the manual electric arc process using electrodes suitable for use with the swing hanger and cross key material.

7.11.4.1 Qualifications

Swing hanger and cross key welding shall be performed by welders who have been qualified according to Section IX of the ASME Boiler and Pressure Vessel Code to positions 2F and 1G.

7.11.4.2 Procedures

1. Surfaces to be welded shall be thoroughly cleaned before welding.

2. Prior to welding, pieces shall be preheated to 400°-500°F and shall not be allowed to cool below 400°F during welding.

3. All worn areas shall be filled by running weld bead parallel (and not transverse) to the long dimension of the piece wherever possible. Extreme care shall be taken not to arc-burn any part of the pieces.

4. Weld buildup shall not be greater than 3/16-inch to restore original dimensions. Where welding is required on both sides of the piece, the total built-up on both sides shall not exceed 3/16" to restore original dimensions.

5. Finish all welded surfaces by grinding or machining, making certain that all scars and undercutting have been removed. All edges shall be rounded leaving a smooth radius. Finish grinding shall be parallel to the section and care shall be taken to prevent frictional discoloration of the surface.

6. After welding, the pieces shall be normalized and tempered. The Contractor shall develop normalizing and tempering procedures (temperature-time) suitable to the material.

7. During heating operations, initial furnace temperature shall not exceed 700°F and pieces shall be heated at a rate not exceeding 500°F per hour. After heating and holding, pieces shall be removed from the furnace and cooled to room temperature in still air. When heating or cooling pieces, they shall not be stacked on top of one another and shall be properly supported so as to allow uniform heating and cooling without distortion.

8. Pieces shall be Brinnell hardness tested after heat treatment. Hardness range is to be BHN 229-277.

9. Swing hangers and cross keys shall be magnetic particle tested after heat treatment.

7.12 WHEELS AND AXLES

7.12.1 Wheel Sets

Wheel sets shall be removed and forwarded to an AAR-approved wheel shop for cleaning, inspection, repair, lubrication, or scrapping and replacement of wheels, axles, bearings, brake discs, drive gears, and speed sensing devices.

Wheels shall be renewed if rim thickness after turning to full narrow flange contour will be less than 1½-inch. Where wheels are removed from axles, the brake discs on that wheelset shall be renewed.

The trucks on the Railcars are equipped with two (2) axles per truck.

When applying wheel sets to a truck, care shall be taken to match the sets so that there is not more than ½-inch difference in wheel diameter.

The repair and manufacture of all wheel sets shall conform fully to the AAR Standards and Recommended Practices contained in the AAR Wheel and Axle Manual, Sections GH, and the AAR Roller Bearing Manual, Section H II.50

7.12.2 Wheels

All wheels shall be nominal 36 inch size type E-36 conforming to AAR requirements for passenger Railcars and machined in accordance with the AAR Wheel and Axle Manual. Wheels reused in this program shall have a minimum of 1½ inch rim thickness following machining to AAR full narrow flange tread contour. Reusable wheels dismounted for renewal of brake discs or gear units may be remounted provided all requirements of Wheel & Axle Manual Rule ID6 are met.

All wheel pressure graphs and inspection records shall be supplied in the Car History Book.

New wheels shall be AAR design E-36, Class C, manufactured and inspected to AAR Specifications M107.

7.12.3 Axles

All axles shall be 6" x 11" size, inspected and machined in accordance with the AAR Wheel and Axle Manual.

New axles shall be Grade F, manufactured and inspected to AAR Specifications M101

All axles shall be marked in accordance with AAR Specification M101 and the Wheel and Axle Manual. A record of all axle markings shall be supplied in the Car History Book.

7.12.4 Journal Bearings and Boxes

All journal bearings reused in this program shall be dismantled, cleaned, inspected and repaired in accordance with manufacturer's maintenance recommendations. All work shall be performed in a clean environment. All bearings shall be marked as to date and place repaired or applied new. New or rebuilt bearings shall be Timken APEE 6" x 11" and shall be applied on a wheelset basis.

Journal bearing boxes shall have prehardened manganese steel wear plates, secured by welding and installed to provide a journal box face width of 13-3/16 inches.

Journal bearing boxes shall be machined to Timken approved drawings as required to accommodate APEE type bearings.

7.12.5 Brake Discs

New brake discs shall be installed on new wheels.

Existing brake discs shall be cleaned, inspected for cracks and wear and the required repairs shall be performed in accordance with the manufacturer's recommendations. Manufacturer's recommended maintenance procedures shall govern the condemning and repair limits of brake discs.

7.13 OTHER TRUCK COMPONENTS

Prior to reinstallation in the rebuilt truck assembly, the following truck components shall be overhauled or rebuilt in accordance with other sections of the Specifications.

- Disc Brake Units
- Hand Brake Linkage

7.14 PIPING AND WIRING

Existing brake cylinder piping to the disc brake units shall be thoroughly cleaned in accordance with the requirements of Section 5.15.1 or shall be replaced, and reassembled with new flexible hoses and the reconditioned disc brake units.

7.15 REPLACEMENT PARTS

The following truck parts shall be replaced with new materials.

- Equalizer and Bolster Spring Pocket Fabreeka Liners
- Pedestal Liners
- Wheels (as required)
- Axles (as required)
- Brake Discs (as required)
- Journal Bearings (as required)

- Lateral Bumpers (on truck bolster)
- Vertical Shock Absorbers
- Center Plate horizontal and vertical liners
- Side Bearing Plate (as required)
- Disc Brake Pads (as required)
- Air Brake Flexible Hoses
- Standard Bolts (including Grade 5), Elastic Stop Nuts,
- Cotter Pins
- Pins and Bushings (as required)

7.16 ASSEMBLY

When assembling the truck, care shall be taken to ensure that design dimensions, as shown on the truck manufacturer's drawings, are maintained between parts. This is necessary to ensure proper operation and ride quality.

7.17 ADJUSTMENT AND TEST

7.17.1 Leveling Railcar and Correction of Lean

Leveling and adjustment of Railcar height shall be done on straight and level track.

A stationary Railcar sitting on properly adjusted trucks and on straight and level track shall not lean more than 1/2 inch in 10 feet.

Correction of lean shall be made by adding shims under bolster springs or at the swing hanger bearing on the low side, and/or by removing shims on the high side. Railcar floor, coupler and buffer heights shall be maintained. Shimming in any location shall not exceed the dimensions specified in Section 7.19.3 with sound deadening pads maintained. Adjustment of shims at equalizer springs shall only be made if correction cannot otherwise be made.

Application of shims at side bearings is not permissible for correcting lean.

7.17.2 Adjustment of Side Bearings

When the carbody is set on the trucks, the weight of the Railcar shall be carried at the center plates. The side bearings shall not carry weight but shall only restrict the rocking motion of the Railcar body. With the Railcar resting on the center plate, the side bearings may require adjustment by shimming under the base plate. The rubber cushions shall not be compressed more than 1/32 inch.

Shimming, as required, shall be done using shims in increments of 1/16 inch, 1/8 inch, 1/4 inch and 1/2 inch thickness.

7.17.3 Adjustment of Railcar Height

The following dimensions shall be maintained:

- Top of Rail to Top of Buffer Plate . . . . 50½ + ½-0"
- Maximum Height Difference between Ends of Car . . . . . 1"
- Top of Rail to Center Line of Coupler . . . . 34±½"
- Minimum Clearance Top of Rail to Undercar Equipment . . 8"
- Minimum Clearance between Top of Rail and Any Truck Part 2¾"

7.18 GROUNDING

Ground straps shall be provided between carbody and truck bolster, truck bolster and truck frame, and truck frame and one journal box of each wheel set.

FRICTION BRAKE SYSTEMS
SECTION 8

8.1 GENERAL

The Railcars shall be equipped with a Schedule 26C pneumatic brake system using a 26CV-8 control valve. Except as provided in the Specifications, this system shall be overhauled in kind.

Requirements for the overhaul of the wheel slide protection system are provided in Section 6.5.

8.2 BRAKE RATES

The air brake system shall provide rapid "SERVICE" and "EMERGENCY" response at all times and shall permit prompt recharge of the brake pipe after an "EMERGENCY" application and after the vent valves have closed.

- "FULL SERVICE"

  The "FULL SERVICE" braking rate shall be a minimum of 2.0 mphps, average, from 70 mph to stop. The maximum instantaneous rate during a stop shall not exceed 2.75 mphps.

- "EMERGENCY"

  The "EMERGENCY" braking rate shall be a minimum of 2.50 mphps, average, from 70 mph to stop. The maximum rate during a stop shall not exceed the limits of clean, dry rail adhesion.

8.3 DISC BRAKE UNITS

The existing disc brake units shall be reused and shall be rebuilt following Amtrak rebuild and test procedures. The rebuild shall include all new cylinder diaphragms, bellows, and pins and bushings as required.

All truck-mounted brake structural members shall be completely stripped and magnetic particle or dye-penetrant inspected for cracks. Components requiring attention shall be repaired. All rubber components associated with brake mounting shall be renewed.

Weld repair and grinding of the brake frame shall be performed as may be required. The renewal of brake frames, brake cylinder tongs brake heads or brake cylinders shall be accomplished as determined to be required by the Contractor.

Local "disc brake applied" indicators and function plates shall be installed on the underside of the side sills above each side of each truck (four per Railcar). The indicators shall function to extend their plungers when pressure is applied to their respective disc brake actuators and retract when the pressure is released. They shall be connected to the brake cylinder piping between the disc brake actuator and the cut-out cock for each truck.

8.4 CONTROL VALVE AND OTHER CONTROL VALVE ASSOCIATED COMPONENTS PORTIONS

The 26-CV8 control valve and other control valve associated components (relay valves, application valves, vent valves, etc.) shall be reused and shall be rebuilt following the air brake company's rebuild and test procedures. The shop used shall be AAR certified.

Air brake apparatus shall be so located as to permit ready removal from pipe brackets for inspection, cleaning and repairs.

8.5 AIR GAUGES

The Spa Car shall have one (1) simplex gauge which shall indicate brake pipe pressure.

8.6 BRAKE CYLINDER CUT-OUT COCK

A vented cut-out cock shall be provided in the brake cylinder line of each truck for cutting out the brake cylinders. They shall be readily accessible from the side of the Railcar near each truck.

8.7 HANDLE POSITIONS

All cut-out cock handles except brake pipe angle cocks shall be arranged to be parallel with the pipe in the closed position and perpendicular to the pipe in the open position. Cut-out cocks shall be oriented to a position that shall not allow the valve handles to vibrate to the opposite position in service.

8.8 EMERGENCY BRAKE VALVE

A B-3-B emergency brake valve or equal shall be provided at each end of the Railcar, inside the passenger section. This valve shall vent the brake pipe through an E-3 brake application valve, initiating an emergency brake application under all conditions. Each valve shall be marked with a permanent label, "Emergency Brake Valve".

8.9 RESERVOIRS

The existing main reservoirs shall be removed, cleaned, tested and inspected. Reservoirs which are not usable shall be renewed.

Supply and auxiliary reservoirs shall be removed, cleaned, tested and inspected. Reservoirs which are not usable shall be renewed.

Drain valves and cocks shall be guarded to protect them from ballast and other undercar debris.

8.10 BRAKE PIPE AND RESERVOIR PIPE

The existing brake and main reservoir piping shall be removed and replaced with schedule 80 black iron pipe as required. Piping shall be clamped in accordance with AAR requirements.

Each Railcar shall have an Amtrak approved main reservoir trainline pipe.

9.1 ELECTRICAL SYSTEMS

9.1.1 General

The Railcars shall be designed with a Head End Power (HEP) System compatible with Amtrak service. The Head End Power System shall provide 480 VAC, three-phase, 60 Hz power from the installed diesel generator sets in the Power Car. The required generator control circuitry that regulates the generator output and allows the generators to be operated independently or in parallel is located in the Power Car. The main distribution switchboard and protection devices are also located in the Power Car.

In the individual Railcars, transformers convert the 480 VAC to 208/120 VAC to service the particular electrical loads of that Railcar.

Provision is made for the connection of an external 480 VAC three phase power source through receptacles on each end of the car (see Section 9.6).

The Intermediate Power Supply (IPS) shall be a 208/120VAC, three phase, 60 Hz system. This system shall be powered from the HEP System through transformers and suitable circuit breakers and shall feed the following:

- Main interior lighting, including all staff and passenger areas
- Convenience receptacles throughout the Railcars
- Pumps and other machinery
- Communications and electronics
- Emergency lighting system battery charger(s)

The Low Voltage System shall be a 12 VDC system utilizing a Low Voltage Power Supply that draws power from the Intermediate Power Supply or in an emergency, from 12 VDC batteries. These batteries are kept ready for service via a charging circuit from the IPS.

The Low Voltage System shall supply power for emergency lighting, control systems and communications systems as may be required.

The design and the major components for the HEP System including the Low Voltage System shall be submitted for Approval.

9.1.2 Removals

With the exception of the Locomotives, Staff/22 and Staff/8 Railcars all carbody wiring and associated equipment shall be removed from the Railcars.

9.1.3 Wiring

Removed carbody wiring shall be replaced with new wiring which shall be installed in accordance with the Specifications.

Trainline junction boxes shall be provided at locations per Amtrak Specifications at each end of the Railcars. All connections from the communication trainline receptacles shall be terminated in these junction boxes.

9.1.4 Voltages

9.1.4.1 Head End Power Supply

The HEP System voltage, supplied by the diesel generator sets (gen sets) in the Power Car shall be 480 VAC, three-phase 60 Hz. The HEP System shall have the capability to supply the complete electrical load for the Trainset under conditions of electrical demand including the condition where the Trainset's interior temperature is being brought to normal temperature with all lights on after storage at high or low ambient temperatures with two (2) generator sets on the line in parallel. In the event only one (1) generator set is available, at least 85% of the Trainset's normal load shall be capable of being supplied.

The steady-state output voltage shall be 480 ± 3 percent VAC RMS phase-to-phase.

Rotating machine loads, such as the air conditioning compressors, can momentarily draw large inrush currents. In such circumstances, when applied to a partially-loaded system, the HEP System voltage shall not dip by more than 15 percent. When the current peak abates, the output voltage shall recover to the specified regulation values within one (1) minute. Inrush conditions shall not cause shutdown of the HEP Supply unit(s) nor activation of any of the protective devices.

9.1.4.2 Intermediate Power Supply

The Intermediate Voltage Power System voltage shall be 208/120 VAC nominal, 60 Hz. Power for this system shall be provided by transformers fed from the HEP Supply. The voltage and frequency shall be derived from the HEP System. The Intermediate Power Supply system shall have capacity to supply all main lighting, convenience receptacles and other connected electrical loads if required in the respective Railcar. Each Railcar shall be provided with transformer capacity sufficient to service the connected IPS load.

9.1.4.3 Low Voltage Power Supply

The Low Voltage Power System voltage shall be 12 VDC nominal.

The Emergency Lighting System and the rear of Railcar marker lights shall be operated form the 12 VDC Low Voltage Power Supply and shall be capable of automatic and manual operation. In the emergency mode the Emergency Lighting System shall be capable of providing a minimum of two (2) hours of continuous service.

The Emergency Lighting shall be provided for aisleways, restrooms, stairways, kitchens, lounges, dome, staterooms, office and dining areas.

9.1.5 HEP Unit

9.1.5.1 General

Two (2) new packaged Caterpillar diesel engine-driven generator sets shall make up the HEP Unit to provide 480 volt, 3 phase, 60 hertz power in accordance with requirements of Section 9.4.1. The generator sets shall be completely self-contained and shall be designed to allow convenient access for all running maintenance requirements. Each generator set shall consist of a diesel engine, a brushless 480 volt, 3 phase, 60 hertz alternator, an engine start/control gauge and monitoring panel, a self-contained engine cooling system, a mounting frame with inherent resilient vibration isolation mounts and all necessary control devices.

The design shall minimize carbody interface connections.

Following the Contractor's normal design process, the finalized HEP Unit System design shall be presented to PM for Approval.

9.1.5.2 HEP Unit Diesel Engines (Caterpillar Model 3508TA)

The HEP diesel engine(s) are expected to experiences service which is characterized by extended periods of continuous operation at low load conditions and only limited operation at or near fully loaded conditions.

The diesel engines shall each be equipped with a 12 VDC electrical starter.

The engine cooling system shall be totally self-contained (no external piping) and arranged to draw cooling air from outside of the Railcar.

The engine cooling system design shall also provide for the use of the engine jacket waste heat to provide hot circulating water to the Waste Heat Recovery System (see Section 9.4). The circulating pumps and jacket water to waste heat recovery system heat exchanger shall be located in the Power Car. Engine coolant level inspection and filling provisions shall be readily accessible.

The exhaust systems shall be as described in Section 13.1.

Crankcase ventilation/filtration/recirculation system shall be provided in the Contractor's final design.

Oil and fuel filters shall be spin-on type and shall be easily accessible. The filters shall be vertically oriented (connection side up) to avoid spillage during removal.

Diesel engine speed governor shall maintain the alternator performance requirements in Section 9.4.1 under all loading conditions and stepped load changes.

9.1.5.3 Alternator (Caterpillar supplied 820KW-SR-4)

The alternator shall meet the requirements of Section 9.4.1.

The alternator shall be a brushless type. The power required for excitation of the alternator shall be derived from an exciter on the drive shaft. This exciter shall be fed from the alternator output and controlled by a semiconductor regulator.

The nominal, steady state output of the alternator shall be 820 KW, 480 VAC, 3-phase, 60 Hz. The output circuit shall be completely isolated from ground.

The alternator main and exciter coils shall be insulated for Class F (per IEEE Standard 11) temperature rise or better. The actual temperature rise shall not exceed Class F.

Sealed anti-friction bearings shall be provided.

9.1.5.4 Controls

9.1.5.4.1 General

There shall be an independent control breaker as specified in Section 9.9.2.7 for each alternator. Sequential starting of major loads such as air conditioning compressors shall be provided.

A diesel generator fault signal shall be transmitted to the HEP Unit fault trainline whenever 480 volt power is lost for any reason other than normal or timed shut down control. A fault light shall also be provided.

9.1.5.4.2 Start/Control/Monitoring Panel

Each diesel engine shall be manually started by means of a push button on, or adjacent to, the HEP Unit control panel. The control panel shall contain, as a minimum, control and monitoring devices or indicators to perform the following functions or determine the status of operating parameters:

- Push Buttons
  - Engine Start
  - Engine stop
- Gauges
  - Engine coolant temperature
  - Engine oil pressure
  - Engine hours
- Meters/Indicators
  - Ground fault on (each phase)
  - Voltage (each phase)
  - Current (each phase)
  - Frequency
- Fault Shutdown Indicator Lights
  - Hot Engine
  - Overspeed
  - Over-voltage
  - Under-voltage
  - Over-frequency
  - Under-frequency
- Main 480 volt circuit breaker
- Synchroscope for paralleling generator sets

The fault circuitry shall maintain fault light illumination until the fault is reset by the reset switch, even if the fault self clears. A total loss of control power shall not reset the fault and the tripped fault light shall be re-illuminated when power is restored.

9.1.5.5 HEP Unit Power Car Installation

The HEP Unit installation in the Power Car shall meet the requirements of Section 2.6.5.3 and shall provide physical protection to the HEP Unit and its components, as well as providing an effective noise barrier. Cooling air inlets and outlets shall be arranged to allow sufficient airflow to the engine radiator but shall be positioned to minimize engine noise transmission to the wayside or to other Railcar interior(s). Open access to the generator sets shall be provided to facilitate routine maintenance procedures such as oil changes, liquid level checks and engine repair.

9.1.5.6 Carbody Interface

9.1.5.6.1 Mounting

Each diesel engine-alternator assembly shall be resiliently mounted on a rigid mounting frame.

The vibration isolation system between the generator set assembly and the rigid mounting frame shall be designed to meet the requirements of Section 2.7.3 when the mounting frame is hard-connected to the Railcar. The entire mounting system shall meet the requirements of Section 3.8.3.

In addition to meeting the noise requirements of Section 2.7.2, the resilient mounts shall provide adequate isolation for all modes of vibration. The resilient mounting system shall be designed with sufficient clearance to allow isolation without contacting limiting stops throughout all modes of normal operation. However, positive mechanical stops shall be provided to safely restrain the equipment and avoid damage to the resilient elements due to momentary shock loads.

9.1.5.6.2 Exhaust System

A new exhaust system shall be designed to route the engine exhaust to the roof. The exhaust shall be routed so as to avoid radiated heat damage to adjacent items. If necessary, the exhaust shall be insulated. A minimum of one (1) inch spacing between the exhaust pipe outside diameter and the exhaust riser duct inside diameter shall be provided. The car side (outer periphery) of the exhaust duct shall be thermally and acoustically insulated in accordance with Section 3.9.

A flexible connector shall be provided to isolate the engine from the carbody mounted exhaust piping. The interface exhaust connection to the car exhaust piping shall be by means of a 2-bolt flange or Marmon type exhaust connector. Slip-on U-bolt type connectors will not be permitted.

9.1.5.7 Fire Suppression System

The diesel generator compartment in the Power Car shall be provided with a fire extinguishing system as described in Section 13.3

Activation shall be by means of a clearly identified 'D' ring and cable arrangement near to the extinguisher or automatically as a result of heat sensor activation. The condition of charge shall be displayed by gauges mounted near the extinguisher.

9.1.6 Battery System

9.1.6.1 Battery

At normal operating temperature (70° to 77°F) the battery shall have sufficient capacity to provide all 12 VDC emergency functions for two hours.

9.1.6.2 Low Voltage Power Supply

The Low Voltage Power Supply (LVPS) shall be provided, which shall take power from 480 VAC HEP System via transformers and provide 12 VDC for the low voltage power system.

The LVPS shall have the capacity to supply the complete electrical demand of the low voltage system. The LVPS output shall be current-limited by reducing the output voltage while maintaining the maximum current output in order to provide protection while allowing initial battery charging. The maximum current shall be limited to a level that prevents an excessively high charge rate for the battery.

The LVPS shall regulate the output voltage within 1.5 VDC. All equipment powered by the Low Voltage Power System shall conform to the requirements of Section 2.6.3.

For load or fault conditions of very low load resistance, (such as a dead short), the LVPS control shall 'fold back' (limit both current and voltage), disconnect the output, or shut off. Normal operation shall automatically resume when the overload or short circuit is removed.

The LVPS shall automatically start when HEP is applied. Battery power shall not be required as a prerequisite to starting the LVPS.

9.1.6.3 Battery Circuit Protection

A two-pole circuit breaker shall be provided for battery and circuit protection. The circuit breaker shall be mounted in a separate enclosure located adjacent to the battery box.

9.1.6.4 Battery Box

The existing battery box shall be repaired and restored as required or replaced with a new battery box at the Contractors option. The covers and all hardware on the existing battery boxes, if used, including hinges and latches, shall be replaced or restored to original condition so that they shall fit properly and close securely. Means shall be provided within the box to prevent battery movement. No combustible materials shall be used for either the battery blocking or box lining.

9.1.7 Intermediate Power Supply and Convenience Receptacles

9.1.7.1 Intermediate Power Supply

Transformers shall be furnished on each car to convert 480 volt three-phase to 208/120 volt single phase power. The transformer group shall have a rated capacity sufficient to supply all the required 208/120 VAC loads. The transformer shall conform to the requirements of Section 16.31.8 and be an encapsulated, totally-enclosed, non-ventilated dry type distribution transformer, built to the requirements of the revisions of ANSI, NEMA and IEEE Standards for transformers in effect on the date of signing of the Agreement. If the group is located under the Railcar it shall be suitable for exposure to the environment described in Section 2.5.2.

9.1.7.2 Service and Convenience Outlets

Service outlets shall be provided in areas and at required voltages for appliance and maintenance functions. Outlets will be rated at 120 volt and 208 volt single phase.

The Power Car, Staff/22 and Staff/8 Cars shall remain configured as existing, unless the Contractor's design provides otherwise.

9.1.8 Switch and Breaker Panels

Switch and circuit breaker panels shall be provided as shall be determined by the Contractor's design and the Specifications.

9.1.8.1 Panel Arrangement

Switch and breaker panels for the electric lockers and breaker panels shall be provided by the Contractor as required by the Specifications. These enclosures shall be lined with an insulating material.

Each panel shall have a dead front of laminated phenolic suitable for switchboards or, if metal is used, it shall be suitably protected by grounding.

Each panel shall contain the necessary apparatus, so arranged as to be accessible to connections and designed to prevent an operator from coming in contact with energized parts when operating switches or circuit breakers. The electrical connections shall be accessible from the front of the individual device with the dead front removed. All switches and breakers shall be provided with a nameplate attached with rivets or tamperproof screws on the dead front, clearly identifying the circuit that each controls.

9.1.8.2 Switches

Switches shall be of the heavy duty, toggle action, indicating type unless otherwise specified. They shall conform to the requirements of Section 16(5).31.3?.

9.1.8.3 Circuit Breakers

Circuit breakers shall be toggle action, trip free, shock resistant, with proper ratings and suitable for railroad service.

9.1.9 Grounding

Grounding to the carbody shall be provided for the following units as a minimum, in addition to the grounding requirements of Section 15.16.5

Fuel Tank
HEP Unit Engine-Alternator
Circuit Breaker and Switch Panels
Air Conditioning Unit Frames
Lighting

The necessary grounding connections shall be provided for the ground fault protective device in the convenience receptacle circuit.

9.2 POTABLE WATER SYSTEM

9.2.1 General

The potable water system to be installed in the Railcars shall be designed to provide an adequate supply of hot and cold potable water for passengers, staff and hotel service needs, optimal reliability and to meet the requirements of the Specifications

Each Railcar shall have its own potable water system that is capable of meeting the requirements of that Railcar and that is essentially independent from other Railcars. Each of the Railcar potable water systems shall also be designed to use the same components to the extent practical, even though the potable water requirements by Railcar may vary considerably.

9.2.2 Potable Water System Elements

The Railcar potable water system consists of the following:

1. One (1) or more High Density Polyethylene (HDPE) storage tanks of a total capacity of approximately 1000 gallons mounted underneath the Railcar.

   Each storage tank shall have suitable fill, drain, suction, chemical treatment and sampling connections. Where the storage tanks are used for hot potable water storage, there shall also be suitable return and waste heat recovery system connections. The waste heat recovery system uses and food grade of glycol as the circulating fluid. The storage tanks shall be capable of being filled from either side of the Railcar.

2. Two (2) self-priming Gould pumps, or equal, with suction filters shall be installed to provide adequate cold potable water service throughout the Railcar. These cold potable water pumps shall be mounted under the Railcar.

3. Two (2) self-priming Gould pumps, or equal, with suction filters shall be installed under the Railcar to provide adequate hot potable water service throughout the Railcar. These pumps shall be installed to continuously circulated potable hot water to the potable hot water users.

4. One (1) instantaneous electric heater sufficient to boost the temperature of the potable hot water to not more than 120°F. It shall be installed under the Railcar.

5. One (1) pressure compensating tank shall be installed in the cold potable water line under the Railcar and one in the potable water line.

6. In the Dining Car with Kitchen (Railcar #15) one (1) stainless steel instantaneous hot water heater rated at 120°F water output at a flow rate of 50 gallons per hour shall be installed in the kitchen.

7. Valves, faucets, piping and/or tubing and fittings necessary for the distribution of potable water throughout the Railcar.

8. Potable water lines shall be wrapped with 120 volt heat tape and fiberglass insulation as necessary to meet the environmental operating conditions set forth in the Specifications.

9.2.3 Capacity and Locations

The actual capacity and locations of the storage tanks and other system details shall be determined in the Contractor's final potable water system design.

9.3 SEWAGE

9.3.1 General

The sewage system to be installed in the Railcars shall be designed to provide optimal reliability for servicing the needs of Trainset passengers and staff as well as hotel services. The sewage system shall provide for the carrying and disposal of all waste water' black water (waste from toilets) and grey water (waste from sinks, showers and kitchens) are each handled separately.

Each Railcar shall have its own sewage system that is capable of meeting the requirements of that Railcar and that is independent of other Railcars. Each of the Railcar sewage systems shall also be designed to use the same components to the extent practical, even though sewage system requirements by Railcar may vary greatly.

Black water is held in a black water holding tank(s) and normally discharged during scheduled stops during Railcar operations. Grey water is held in grey water holding tank(s) when the Railcar is in a station. When the Railcar is enroute between stations, the grey water tank(s) discharge to the track bed.

9.3.2 Sewage System Elements

The Railcar sewage system consists of the following:

9.3.2.1 Black Water Sewage System

1. One (1) black water holding tank of a capacity of approximately 300 gallons and made of HDPE shall be mounted under the Railcar. This holding tank shall have suitable inlet, flushing inlet and discharge connections. This holding tank shall be capable of being discharged from either side of the Railcar. A filtered vent and inspection/access cover shall also be installed in the holding tank.

2. One (1) air assisted flush toilet with china bowl of household size manufactured by the Microphor Corp. or equal, shall be installed at each location provided on the Contract Drawings and as a replacement for the existing Staff/22 and Staff/8 Railcars as me be required.

3. Compressed air connections to each toilet shall be made in accordance with the toilet manufacturer's recommendations. The compressed air shall be supplied from the Trainset's main reservoir line.

4. Valves, piping and/or tubing, fittings and connections as necessary for the proper functioning of the Black water sewage system throughout the Railcar.

9.3.2.2. Grey Water Sewage System

1. One (1) Grey water holding tank of a capacity of approximately 400 gallons and made of HDPE shall be mounted under the Railcar. This holding tank shall have a vent, overflow and suitable inlet and discharge connections. This holding tank shall be capable of being discharged manually and by means of a solenoid operated valve.

2. Valves, piping, fittings, and connections shall be provided as necessary for the proper functioning the Grey water sewage system throughout the Railcar.

9.3.3 Capacities and Other Details

The actual tank capacities and other systems details shall be determined in the contractor's final Sewage System design.

9.4 WASTE HEAT RECOVERY SYSTEM

9.4.1. General

The waste heat recovery system shall make use of available heat from the Power Car's installed diesel generator sets. The system makes use of two (20 heat sources from each diesel engine, the exhaust gas and the jacket cooling water. Appropriate heat exchangers use these sources of waste heat to raise the temperature of a food grade glycol that is then circulated throughout the Railcars. The circulating glycol provides heat to Railcar cabin space heaters and to the potable water system for making hot water.

9.4.2. Waste Heat Recovery System Components

The waste heat recovery system consists of the following components:

1. One (1) exhaust gas to glycol heat exchanger system per diesel engine.

2. One (1) jacket water to glycol heat exchanger per diesel engine.

3. One (1) glycol storage/expansion tank suitably sized and made of HDPE for use by the waste heat recovery system.

4. Controls, valves, piping, and/or tubing, fittings and connections as necessary for a properly functioning with either or both generator sets in operation.

9.4.3 Capacity and Other Details

The waste heat recovery system heat exchanger, pumps and controls are located in the Power Car. Circulating piping for this system is located throughout the Railcars as determined by the system design.

The actual tank capacities and other system details shall be determined in the Contractor's final waste heat recovery system design.

9.5 HEATING, VENTILATING AND AIR CONDITIONING

9.5.1 General

Each car shall be provided with a new heating, ventilating, and air conditioning (HVAC) system to meet the requirements identified in this Section. The HVAC system, including all equipment and components defined herein, shall be service-proven as used by Contractor in Alaska train service.

Each car shall have a direct expansion system using Refrigerant 22 (R-22) or an approved alternate. Like units shall be interchangeable among all cars. Equipment design and installation shall provide full accessibility for maintenance, troubleshooting, and repair without interference from other systems.

The control system shall be designed to automatically maintain the required Railcar interior temperature and relative humidity, under the ambient conditions specified including solar load and with or without variable internal heat loads such as passengers, motors, and lights. The control system for each unit shall operate from its own low voltage transformer and its sensitivity and accuracy shall permit the requirements of this Section to be met.

The HVAC equipment shall be tested in accordance with the tests section of the Specifications. Sound levels shall meet the requirements of the Specifications.

9.5.2 Air Ducts

Air supply and return ducts shall be provided in sufficient size to meet the temperature requirements of the Specifications. Such ducts shall be constructed of galvanized steel, aluminum, FRP or stainless steel as appropriate and shall be properly insulated to achieve the noise standards of the Specifications and to prevent condensation on duct shells.

Supply diffusers and adjustable dampers shall be installed as described in the details of each car in Sections 14 through 18, except where fixed dampers are specified.

9.5.2.1 Ventilation

The Railcar shall be ventilated by the fans supplied as part of the evaporator unit or as separate ventilation fans and by associated ducts. A fresh air volume of not less than 1200 cfm per car shall be provided. Ventilation shall be available at all times when the HVAC systems are operating normally. Ventilation shall remain on when either or both of the heating and/or air conditioning systems have failed and are inoperable. Ventilation fans shall be speed controlled form OFF to full speed.

The ventilation system shall maintain positive pressurization of 0.1 inch w.c. with the car stationery.

Fresh air shall be drawn through screened openings on the sides of the car, filtered and then drawn into each air conditioning unit. The fresh air intake design shall, without the use of filters, preclude wind-driven snow or rain from accumulating and leaking into the vehicle interior. The mixing plenum and air ducts shall be sealed so that all fresh air entering the plenum passes through the air filters.

9.5.2.2 Air Filters

Air filters shall be as required by the Specifications. Air velocity shall not exceed 300 fpm across the surface of the filter media. All air filters shall be commercially-available standard size.

New filter pressure drop shall be a maximum of 0.12 in. w.c. The system shall be capable of maintaining the total design air flow against an air flow system resistance that includes twice the clean filter pressure drops at design fan speed.

The filter holders shall be designed to eliminate filter bypass. Filters shall be accessible for replacement through the return air grilles. All filters shall meet the requirements of UL Standard 900, Class 1 or 2.

9.5.3 Heating

9.5.3.1 General

The cars shall be electrically heated by overhead heater elements supplied as part of the HVAC equipment, and by the existing floor level hot water heater pipes installed inside a baseboard enclosure (see Section 9.5.3.3.3). The overhead heating elements shall be powered by 480 VAC. Heating circuits shall use standard U.L. listed or recognized elements, available as manufacturer's stock items.

All heating circuits shall be arranged to facilitate the identification of faulty elements. It shall be possible to locate a faulty overhead heating element using a VOM or equivalent instrument.

Electric heaters shall be provided as a part of the evaporator units to warm ventilation air during heating and for reheat for humidity control. The heater coils shall be located downstream of the cooling coil.

The heaters shall be arranged to operate in two or more stages to provide the specified performance during the heating and reheating modes of operation.

9.5.3.2. Heater Elements

Overhead heater elements shall be low thermal inertia, open-coil, resistance wire-type, with insulated supports. The elements shall not exceed their allowable wattage rating at the maximum line voltage specified in Section 9.4.1?.

9.5.3.3 Protective Devices

All protective devices shall be rated and arranged to provide the required protection without nuisance activation under any operating condition. In addition, each heater circuit shall be individually protected by circuit breakers which meet the requirements of the Specifications.

The following protective devices shall be provided and shall operate in the following sequence:

- An air flow proving switch shall be installed in the blower air outlet. The switch shall remove control power from the heating contactors upon the loss of air flow.

- An automatically resettable high-limit thermostat shall be installed on each heater unit to detect overtemperature. Upon detection of overtemperature, the high-limit thermostat shall open the heat contactors. The high-limit thermostat shall be designed to cycle indefinitely, if conditions dictate, while preventing overtemperature which could cause opening of the back-up protection device (as described below).

- Back-up protection shall be provided by a second thermostat installed on each heater unit. It shall function to remove power in the event of excessive heat and failure of all other protection devices. Upon actuation, it shall open the heat contactors and their power source by means of shunt trip circuit breakers.

9.5.3.4 Reheat Operation

Electric heaters shall also be utilized for reheat during partial cooling. For reheat, heat shall be sized, staged and controlled to offset excessive cooling so that the specified temperature and relative humidity can be maintained.

9.5.4 Cooling System

9.5.4.1 General

The air conditioning system shall be capable of cooling and dehumidifying the car with electro-mechanical vapor-cycle equipment designed for Refrigerant 22 or equivalent alternative refrigerant.

The refrigerant charge weight shall be determined during the first item qualification test. The refrigerant charge shall provide a minimum of 10°F (6°C) subcooling at the thermostatic expansion valve inlet and 10°F ± 2°F (6°C ± 1°C) superheat at each evaporator coil circuit outlet when operating at design-load conditions. Subcooling shall still be present at 115°F (46°C) ambient and 125°F (52°C) condenser air temperature operation with all specified loads on the evaporator. The Contractor shall develop a refrigerant charging procedure for the system for ambients other than design conditions (D7-2).

Every pressure-containing component of the equipment, except piping, shall be certified and listed as having been pressure tested and approved b a nationally-recognized testing laboratory.

The refrigeration system controls shall include an automatic pump-down cycle. Pump-down shall be initiated by closing of the liquid line solenoid valve, after the OFF signal has been received. System refrigerant shall be transferred to the condenser and receiver (if provided) until the compressor suction pressure drops below the low-pressure cut-off set-point, when the low-pressure switch opens and stops the compressor.

9.5.4.2 Design Criteria

The air cooling equipment shall have sufficient capacity to maintain car interior conditions in compliance with the requirements of the Specifications under the following conditions.

• Ambient temperature:	102°FDB 75°FWB
• Condenser Air Inlet temperature:	112°FDB
• Car interior temperature:	75°FDB

with 50% RH

• Passenger load:	111 passengers, 450 BTU/hr/passenger (132 Watts/passenger) with a sensible heat ratio of 55%.
• Fresh air:	1200 cfm (570 L/s) per car
• Total air flow:	Sufficient to meet the internal temperature, humidity and car pressurization requirements of the Specifications but not to exceed 42 cfm per 1,000 Btu/h of rated equipment cooling capacity.
• Lighting load:	Total wattage of interior lights
• Solar load:	In accordance with ASHRAE Cooling and Heating Load Calculation Manual, for Phoenix, AZ on a clear day in July.
• Miscellaneous interior equipment heat rejection:	In accordance with Contractor's design data.

The cooling system shall be able to start and operate without damage at any time of the year when the exterior temperature is above 50°F. The system design shall allow full cooling operation with the ambient temperature up to 110°F (46°C). The cooling system shall also remain in operation, at reduced capacity if necessary, with an ambient temperature of 115°F.

9.5.4.3 Evaporator Section

9.5.4.3.1 Motor-Blower Assembly

A blower assembly shall be supplied as part of the evaporator unit. It shall draw the mixed air through the evaporator, across the heater elements, into the blower and force it into the supply-air ducts from where it shall be discharged into the Railcar.

Evaporator blowers shall be direct driven by fully-enclosed motors powered from the 480 VAC power supply. The blower motors shall have permanently lubricated, rolling-element bearings. The motors shall be accessible for routine inspection and maintenance. The motor shall be grounded to the unit structure.

The motor-blower assembly shall be balanced in accordance with IEEE Standard 11.

9.5.4.3.2 Evaporator Coil Assembly

The evaporator fin coil assembly shall be housed in a painted LAHT housing. The tube support sheets shall be constructed of galvanized steel. The coil shall utilize copper tubes of sufficient wall thickness to withstand the maximum system pressure and aluminum fins with fin spacing of six (6) fins per inch. The evaporator coil shall consist of two separate circuits of the same size using an interlaced (staggered) circuit arrangement to provide two stages of cooling.

The design of the evaporator section of the unit shall provide a space of not less than two (2) inches between the evaporator coil and the heater elements to enable the cleaning of coils by either back-blowing or washing. The air shall not by-pass through the drain pan and around the evaporator coil and heater elements.

9.5.4.3.3 Condensate Drain System

A condensate drain pan shall be provided beneath the evaporator coil, headers, thermal expansion valves, and coil 'U' bends in order to collect condensation.

The drain pan shall be made of galvanized steel, with galvanized steel or copper alloy fittings.

Condensate drain lines shall be sloped for positive drainage to the underside of the car.

9.5.4.3.4 Other Evaporator Components

Other components which shall be included as part of the evaporator section are as follows:

- A liquid line solenoid valve for each circuit of the two-circuit evaporator coils.
- Thermal expansion valve (EV) for each evaporator coil circuit. EVs shall have external equalizers, and field-replaceable working parts. The EVs shall be located to provide convenient access for maintenance. The EV superheat shall be set at 10°F ±2°F (6°C ± 1°C).
- A liquid line sight glass and moisture indicator between the strainer and tee for the two coil circuits.

The liquid fine sight glass and moisture indicator device shall be located for convenient observation.

- The first unit shall have two (2) air pressure taps for measuring evaporator coil air pressure drop. The pressure taps shall be suitable for use with a portable manometer and flexible tubing.

- Pressure tap fittings in each suction header adjacent the expansion valve equalizer connections, for test purposes, on the first unit only.

- Liquid line pressure tap fitting to be used for qualification testing on the first unit only.

9.5.4.4 Compressor/Condenser Section

This section shall include the refrigerant compressor, condenser coil assembly, condenser fan(s), and other components described below.

9.5.4.4.1 Refrigerant Compressor

A Maneurope hermetic compressor or equal shall be provided. The compressor body shall be fitted with a removable heater and an oil level sight glass.

The compressor shall be resiliently mounted to the unit frame. The compressor shall be powered from the 480 VAC power supply and shall be electrically grounded to the frame.

The compressor motor shall contain internal thermostatic protection against excessive motor winding temperature. The location and temperature setting shall be in accordance with the compressor motor manufacturer's recommendations. The internal overtemperature protective device shall act to cease compressor motor operation when the temperature setting is exceeded. The protective device shall be automatically reset, thus allowing-compressor operation to resume when the temperature reduces to a safe level as determined by the compressor motor manufacturer.

9.5.4.4.2 Condenser Coil Assembly

The condenser coil shall be housed in a painted LAHT housing with protective screening. The coil shall be made of aluminum waffle fins with spacing of six (6) fins per inch. Minimum fin spacing shall be 0.125 inch (3 mm). The tubes shall be expanded to positively retain the fins in position. The tube support sheets shall be constructed of galvanized steel. The coil shall utilize copper tubes of sufficient wall thickness to withstand the system pressure. The condenser coil housing shall have removable panels to facilitate the cleaning of the coil.

9.5.4.4.3 Condenser Fan Assembly

The condenser fan(s) shall be direct drive, powered by the 480 VAC power supply. The motor(s) shall be totally enclosed with permanently lubricated rolling-element bearings. The condenser fan motor shall be electrically grounded to the unit housing.

9.5.4.4.4 Other Compressor/Condenser Section Components

Other components which shall be included as part of the condensing section are as follows:

- A serviceable filter-drier assembly in the liquid line. The filter-drier shall be shockproof with a molded porous core and an 80 or 100 mesh screen at the filter outlet. The filter-drier's water capacity, refrigerant flow capacity, filtering area, and acid removal ratings shall comply with ARI Standard 710. The filter-drier shall have rust proof shut-off valves on each side for service isolation.

- Discharge and suction line vibration isolators between the compressor and the rigid piping.

- Protection against refrigeration system explosion: pressure relief device as recommended by UL Standard 465, Section 33.

- Refrigerant piping installation and piping materials meeting the requirements of the Specifications.

- All necessary tubing which shall be arranged to prevent any metal-to-metal rubbing caused by vibration.

9.5.4.5 Refrigeration Control Compartment

The refrigeration control compartment shall be accessible from the side of the Railcar for system servicing. The control compartment shall contain pressure switches, gauge access ports, service valves, and all breakers and contactors except low voltage controls which shall be contained in the car, and main 480 volt breakers which shall be mounted on the main breaker panel, one (1) for each A/C unit.

9.5.4.5.1 Pressure Switches

The following pressure switches shall be provided:

- An automatically-resetting low-pressure cutoff switch shall be provided to monitor compressor suction pressure to protect the compressor and other system components from potentially damaging low-pressure operation. In addition to providing the low-pressure protective function, the low-pressure control shall act as the normal compressor shutoff device following a normal pump down cycle.

- An automatically-resetting, high-pressure cutoff switch shall be provided to monitor the compressor discharge to protect the system from excessively high system pressures. The circuit shall be arranged such that condenser fan(s) operation is not interrupted by the high-pressure cutoff control. When the reset pressure is reached, the compressor shall restart following a time delay of 15 to 20 seconds.

All pressure switches shall be replaceable without brazing or loss of refrigerant.

9.5.4.5.2 Service Valves

Service valves shall be provided for troubleshooting the HVAC system. The valves shall isolate all pressure switches from the system to prevent loss of refrigerant during replacement of any failed pressure switch.

9.5.4.6 Electrical Control Compartment

The electrical control compartment shall be an integral part of the system, and shall be accessible for system servicing from the side of the car. The electrical control compartment shall contain the following components:

- Relays and contactors
- Electrical controls
- Power and control wire terminals

9.5.5 HVAC CONTROlS

9.5.5.1 Operation Control

Each HVAC control shall be activated through an HVAC control circuit breaker in each car. The control circuit breaker in the "ON" position shall allow normal heating and cooling operation. When moved to the "OFF" position, it shall completely shut off air conditioning and ventilation. Interlocking of the blower-fan contactor, overhead heat contactors, and the compressor-motor contactors shall be provided to prevent heater or compressor actuation unless the blower fans are operable. In the "EMERGENCY" position, it shall bypass the temperature sensing and control circuits and operate the air conditioning in the full output mode with high evaporator fan. The emergency mode shall not bypass the system safety sensors or shutdowns.

9.5.5.2 Temperature Control

The control system and its controlled apparatus shall be designed to maintain the interior temperature of the car in accordance with the Specification. This requirement shall be met with the car operating at any speed up to maximum under all specified interior load and outside ambient conditions.

A temperature controller shall control the heating, ventilating, and air cooling system of each system. The temperature control electronics shall be packaged 'm a -single, metal enclosure. Required heat dissipation shall be accomplished by convection cooling. The unit enclosure shall be arranged for removal and replacement with no more than four captive fasteners. All electrical connections shall be by cable connectors.

A scratch-resistant window shall be provided in the cover of the controller directly in front of the status display. The display shall allow all indications to be viewed from inside of the Railcar. The display shall indicate the following, as a minimum:

- Stage 1 Cool
- Stage 2 Cool
- Stage 1 Heat
- Stage 2 Heat
- Temperature set point
- Dehumidification set point
- Dehumidification operation

9.5.5.3 Temperature Sensors

The HVAC system shall be controlled by thermistor sensor(s).

Temperature sensors shall be mounted to minimize their influence by local sources of heat, such as motors or resistors, and by bias from the air streams with different temperatures, such as return and fresh air. They shall be accessible for maintenance and replacement, and protected from damage during routine air conditioning servicing.

Sensor accuracy shall be sufficient to meet the requirements of the Specification.

9.5.5.4 Car Interior Conditions

The average temperature inside the car shall be within the following ranges when the associated ambient temperatures are present.

Ambient Temperature: TA	Interior Temperature: TI
Below 18°F	TA + 51°F minimum
18°F to 40°F	69° to 71°F
40°F to 60°F	72°F TO 75°F
60°F to 102°F	72° to 75°F
102°F to 110°F	TA -27°F
110°F or greater	As the system will provide.

The following variations in interior passenger compartment temperatures are the maximum that shall be allowed during stable operation:

- At any given point in the car, and at least 12 inches from the ceiling and 12 inches from the floor and walls over any period of time: 3°F.
- At any given time, among all points in the same horizontal plane from one end of the car to the other: 4°F.
- At any given time, between any point approximately 48 inches above the floor and the corresponding point 6 inches above the floor in a vertical plane: 4°F.

When cooling is required, the interior relative humidity shall not exceed 55 percent under stabilized conditions where cooling loads are equal to the design conditions. The interior relative humidity shall not exceed 55 percent under stabilized conditions when cooling loads are less than the design conditions.

9.5.5.5 Temperature Control Arrangement

The Contractor shall be responsible for providing airflow uniformity, selection of set-point temperatures, and proportioning of heat and cooling stages to meet the temperature control requirements.

9.6 COMMUNICATIONS

9.6.1. General

Communication apparatus shall be provided for the following services:

- One-way communication from the train crew or operator to passengers inside the train. (Public Address System).
- Two-way communication between each handicapped passenger area and the office located in Railcar #16, Dining Car without Kitchen (Passenger Emergency Communication System).

Communication apparatus described hereinafter shall be powered from the low voltage power supply directly through the Communications System circuit breakers and shall be capable of operation within the voltage range specified in Section 2.6.2.

Switches and relays used in the communication system shall be of ruggedly constructed design, with contacts which provide ample wiping contact, be positive in action and capable of withstanding conditions encountered in railway service.

All apparatus furnished hereunder shall be capable of operation without injury at temperatures listed in Section 2.5.2 with the Railcar heat and air conditioning systems inoperative.

9.6.2 Public Address (PA) System

The PA system shall be capable of providing public address through loudspeakers inside the Railcars from any activated PA Control Panel in the Railcars.

Each car shall have an amplifier, control panel and microphone. The amplifier shall have sufficient output to drive the Railcar speakers at acceptable volume levels. The control panel shall provide for the selection of one (1) of three (3) audio channels as a program source for the Railcar. Additionally, there shall be a two position switch which shall cause announcements made on the microphone to either be broadcast to the whole train or only to the car in which the microphone is located.

Announcements made from a PA Control Panel shall be connected to interior speakers.

9.6.2.1 PA Control Panel

The microphone of the handset shall be of quality suitable for the service intended and shall be designed into the system to assure low feedback and background noise.

If necessary, the ceiling speaker in the area of the communication control panel shall be cancelled when the control panel in its area is activated.

9.6.2.2 Speakers

New interior and exterior speakers shall be installed.

The speakers shall be connected in parallel with uniform polarity to a pair of wires from their respective amplifiers.

Wiring for the speaker system shall conform with the requirements of Sections 5.17, 5.18, and 5.19 of the Specifications. Since no significant current is carried, fusing of the speaker distribution system is not required.

To prevent feedback, speakers located adjacent to the communication control panels or the control head in use shall be automatically disconnected during PA transmission.

9.6.3 Conductor's Buzzer Signal

A trainline buzzer signal system shall be provided.

A buzzer shall be provided in each vestibule. All buzzers shall be connected directly to a trainline circuit.

The buzzer shall be clearly audible in the vestibule under high noise conditions such as a freight train passing on adjacent track.

Buzzer buttons for signalling shall be located and activated as follows:

- One button in the ceiling of each vestibule, activated at all times.

The buzzer signal system shall be supplied from the low voltage system through a separate circuit breaker.

9.6.4 Passenger Emergency Communications (PEC)

A Passenger Emergency Communication (PEC) unit shall be located in each ADA cabin so as to be easily accessible for use from a wheelchair.

The passenger may initiate the call by pressing a momentary action PEC switch on the PEC unit panel. The PEC mode shall be latched on and the PEC call shall be annunciated in the office by means of a one-time call chime and an indicating light on a PEC Reset switch. Activation of the PEC mode shall also cause a light on the activated PEC unit(s) to illuminate. It shall be possible for multiple PEC units to be activated at the same time, with the office personnel hearing all activated units with the office in the listen mode, and the passengers hearing the office personnel at all activated units the in the transmit mode.

The PEC unit shall be marked with graphics to identify it as a "Passenger Emergency Communications" unit, provide operating instructions and a warning against using it for other than emergencies.

The design, functional description and location of the PEC units shall be determined by the Contractor.

10.4 LETTERING, SIGNS AND NUMBERS

10.4.1 General

All graphics applied to the vehicle interior and exterior shall be selected by PM and comply with the Specifications requirements. The type of lettering, location, size, text, color and application shall be selected by PM to the extent not otherwise inconsistent with the Specifications.

All agency, city, county, state and standard "warning' or "prohibited' signs and logos to be installed on the vehicle shall be subject to PM review. The Contractor shall be responsible for procuring and installing all such warning decals except those specifically related to smoking, which decals shall be provided by PM at is sole expense and used on the car, both interior and exterior in accordance with the Specifications.

10.4.2 Exterior and Interior Markings

- Logo - A logo-type design shall be applied to the Railcar exterior in areas to be selected by PM. Logo design and decals shall be furnished by PM.
- For Railcars 1 through 6, the original builder's plate shall be retained in place in addition to the Contractor's plate.
- Contractor's Name Plate - Two builder's plates may be applied to the interior of each vehicle using rivets - or tamperproof fasteners. Plate size, wording and installed location shall be subject to Approval.
- Equipment boxes shall be labeled with safety warnings for High Voltage if appropriate. The labels shall be embossed, anodized aluminum plates, or equal mechanically fastened to the access cover.
- FULLY EQUIPPED FRA PART 223 GLAZING. (1 per car.) Sign lettering shall be a minimum of 3/8 inch high. The sign shall be applied in an approved location on an interior wall.
- Other designations such as information for the mobility impaired and fire extinguishers shall be provided by the Contractor.

The Contractor is responsible for designing all the car graphics so that they are in compliance with the most current requirements of the ADA of 1990.

10.5 FIRE EXTINGUISHER

At Least two (2) approved cartridge fire extinguishers of the dry chemical, stored pressure type, designed for not less than 20 lbs. of dry chemical, shall be provided for each Railcar. One (1) each shall be mounted in each equipment locker and elsewhere as may be determined by the Contractor. The extinguishers shall have a minimum U.L. rating of 10-A:60-B:C and shall be supplied by Amerex, Ansul or equal.

The extinguisher shall be secured in an adequate holder. The fire extinguisher shall be accessed through a transparent polycarbonate cover secured in a neoprene glazing section. The holder for the extinguisher shall have base brackets and quick - release binding to keep the extinguisher from rattling. The holder and release design shall be determined by the Contractor.

10.6 EMERGENCY TOOLS

An emergency tool case shall be located as determined by the Contractor's design.

The emergency tools shall consist of one 27 inch wrecking bar, one 6 lb sledge hammer and one 4.5 lb axe. The tools shall be securely fastened in the case so that they do not rattle and shall be fitted with a quick-release arrangement for removal.

10.7 KEYS

Fifty keys shall be delivered to PM. The key shall operate the following:

- Body End Door Lock
- Electric Lockers
- Kitchens, doors and storage cabinets
- Bar cabinets
- Office

The design of the key shall be developed by the Contractor uniquely for PM.

10.8 SAFETY APPLIANCES

All safety appliances shall conform to FRA rules and regulations. All existing safety appliances shall be removed, cleaned, sharp edges deburred and be straightened or renewed as required. All reconditioned safety appliances shall be reinstalled using stainless steel fasteners.

10.9 LADDERS AND LADDER SUPPORTS

All existing ladder rests and adjacent handholds shall be removed, cleaned, sharp edges deburred and be straightened or renewed as required. All reconditioned ladder rests and adjacent handholds shall be reinstalled using stainless steel fasteners.

10.10 FIRST AID KIT (PM furnished item)

10.11 HANDBRAKE

The cars are presently equipped with either one or two handbrakes which may be of the lever or wheel type. Where existing, these installations shall be maintained in kind.

All handbrake units shall be removed from the Railcar, and shall be dismantled, inspected, rebuilt, tested and lubricated in accordance with the manufacturer's maintenance instructions. All parts worn beyond limits shall be renewed.

After reinstallation, proper operation of the handbrake shall be verified in accordance with the requirements of Section 4. A single handbrake applied with 125 lbs. force at the rim of the wheel, or 3 inches from the end of the lever shall be capable of holing a car with the equivalent of a full-seated passenger load on a 5 percent grade. Each handbrake shall operate smoothly, without binding.

Completed handbrake installations shall be stencilled with date of overhaul.

10.12 DIAPHRAGMS

Existing diaphragm installations shall be refurbished or scrapped and replaced to make the Railcar compatible with the rubber tube type diaphragms for Amtrak service. Where Contractor determines necessary, mounting fixtures shall be removed and holes in the end frame shall be plugged or covered and appropriately finished to match the existing end sheets.

New diaphragms shall be designed and fabricated as required to provide sufficient headroom and to allow safe passage between Railcars.

Components shall be replaced as necessary to assure "as new" performance.

10.13 BUFFERS

Buffer assemblies on all Railcars shall be rebuilt. All Buffer parts shall be dismantled, inspected and renewed or restored as necessary to assure "as new performance".

After reassembly, buffers shall move freely and without binding through their full travel.

RAILCAR - GENERAL
SECTION 11

11.1 GENERAL

This Section describes the Contractor work that is generally applicable to the Railcars. The principal subassemblies of the carbody and their various parts and materials of construction are defined. The shelling (stripping of appropriate Railcars to the underframes for subsequent use as domed Railcars) is outlined, and the required cleaning defined. New structure is described. Finally, the stress analysis required to verify the strength of any new or replaced structure is specified.

11.2 DESCRIPTION OF EXISTING RAILCAR BODY STRUCTURE

11.2.1 General

The principal parts of the carbody structure are the underframe, the end underframes, the end frames, the side frames, the roof and/or glass dome bows as appropriate, and the vestibules. The Railcar structure is designed as a modified girder using the side frames as the shear webs and the roof and/or glass dome bows and underframe as the top and bottom as applicable as the main structural elements. The Railcars shall be designed to AAR standards and recommended practices:

Car bodies shall be of the following types:

1) Ultradomes: 13 former SP commuter cars
2) Spa Car: 1 former Soo line diner/crew car
3) Power Car: 1 former baggage car
4) Staff Cars: 3 single level existing cars

For the Railcars that shall become Ultradome cars (i.e. the Sleeper Cars, Dining Cars and Lounge Cars), bodies, will be stripped to the base frame, removing all piping, brackets and miscellaneous unneeded metal.

All draft pockets, bolsters, center pins, center sills and debris guards will be repaired and reconditioned in accordance with AAR Specifications.

The Power Car's existing shell will remain intact, being reinforced as necessary to support the diesel generator sets. The Power Car will not have FRP skins, but will be painted in the same color scheme as the other cars.

Staff Cars will be refurbished as necessary to meet pre-agreed upon standards. Crew cars will be painted in the same color scheme as the other cars and will not have FRP skins.

All Ultradome Railcars, i.e. Sleeper Cars, Dining Cars, and Lounge Cars, will have FRP skins which shall be painted in the PM selected color scheme prior to installation of the FRP skins on the Railcar frames on the respective Railcars.

The Spa Car will not have FRP skins but will be painted in the same color scheme as the other cars.

11.2.2 Material

Side frames, roof, end frames, end sills and underframes are made of LAHT and fabricated by welding.

End underframe units, consisting of the body bolster, draft sill extension (including draft gear pockets and other adjacent structures), and coupler carrier supports are made of low alloy, high tensile steel, (50,000 psi minimum yield strength and 70,000 psi minimum ultimate tensile strength).

Carbon steel and aluminum may be used where strength or resistance to corrosion is not of primary importance, such as for brackets and supports.

11.2.3 Underframe

The underframe consists of a center sill and cross members. The center sill extends between body bolsters and is braced by crossbearers. Close-spaced transverse floor members are welded to the center sill between cross bearers. The crossbearers and the body bolsters are connected to side sill members and to the side posts by a special joint construction. The floor cross beams also are connected to the side sill.

11.2.4 End Underframes

An end underframe unit, assembled by arc welding, is installed at each end of the Railcar. The end underframe includes the draft sill extension, body bolster and the combined end sill and coupler carrier support. The outboard end of the end underframe is welded to the end frame, and the ends of the body bolster are welded to the side sills. Extensions of the end underframe are welded to the center sill inboard of the body bolster.

Body center plates of alloy steel are welded to the bottom flanges of the end underframe at the joint between the body bolster and the draft sill.

11.2.5 Side Frames

On the non-glass domed Railcars, i.e. Power Car, Staff Cars and Spa Car the side frames consist of posts, longitudinal rails and flat panels. As stated in Section 11.2.1, the side frames are the shear-carrying members of the modified girder carbody design.

On domed Railcars the sideframes are constructed of LAHT tube steel with the framework bending accomplished by a cold process bending method.

Structural posts are located at the sides of the window and door openings. Additional posts or stiffeners may be used where required.

11.2.6 End Frames

Vertical collision posts at each side of the carbody end openings are fastened securely into the end plate structure in the plane of the vestibule ceilings, and at the bottom are welded to stubs extending up from, and welded to, the end sills.

The exterior face of the Ultradome Railcar ends is made of Fiberglass Reinforced Plastic (FRP). The materials are as existing for the Power Car and Staff Cars, stiffened where necessary, and welded securely to the side frames, roof, end sills and collision posts. The Railcar ends at each corner post are reinforced to aid in transferring end impact loads into the side sills and main Railcar structure.

11.2.7 Roof

The ends of the roof are made of smooth steel sheets, formed down to meet the end frame.

11.2.8 Vestibules

The vestibule is the area at the end of the Railcar between the partition at the end of the passenger compartment and the end frame. It consists of a curved single sheet roof, the steps, trap doors, a slip resistant floor.

11.2.9 Jacking Pads

Eight (8) jacking pads are provided, one at each end of each body bolster.

11.2.10 Waterproofing

On the exterior, the cars are made entirely of FRP for the Ultradome Railcars, i.e. Sleeper Cars, Dining Cars, and Lounge Cars and for the Spa Car. For the Power Car and Staff Cars the sides are of existing materials except for signs, which are painted. All joints in the roof, end walls and sides will be made waterproof.

11.3 STRIPPING

11.3.1 Interior

At the Contractor's option, the interior shall be completely stripped and replaced with new materials, or partially stripped and rebuilt as specified in Sections 3, 5 and 7.

11.3.1.1 Interior-Stripping

With the exception of the Staff Cars and only to the extent Contractor deems necessary for the Power Car, all equipment, interior linings and trim shall be removed from the carbody interior. All light fixtures, wiring, ducts, piping, seats, carpeting, and baggage racks shall be removed. Some cars may have toilet compartments; these and all contained equipment shall be removed. All windows, window frames and sills, roller shades, and rubber glazing strips shall be removed.

11.3.2 Exterior

For non-Ultradome Railcars underfloor equipment shall be removed and inspected for reuse.

All piping that will not be reused shall be removed.

For the Power Car, Staff Cars and Spa Car, all paint and body putty used to fill dents and cracks shall be removed completely down to the bare metal. All obvious temporary patches shall be removed. Such stripping will disclose the full extent of cracks and dents.

11.3.3 Asbestos Removal

Some of the cars may contain asbestos or asbestos-bearing materials. The presence of asbestos has not been confirmed, but shall be investigated during the stripping and inspection process on each car. The Contractor shall be responsible for the investigation, identification, and disposal of asbestos--containing materials on each car. All asbestos-containing materials discovered shall be removed and disposed of in accordance with the provisions of the "Hazardous Material Including Asbestos".

11.4 CLEANING

11.4.1 Interior

For the Power Car and Staff Cars the interior of the roof shall be cleaned sufficiently so that, if present, any small holes or cracks in the roof may be detected. Where the Contractor deems necessary, the interior of the side frames shall be cleaned so that weld joints and spot welds can be inspected for cracks. Critical areas are the top and bottom connections of both the collision posts and the corner posts, the connections of the bolsters to the side sills, and the connections of cross bearers to the side sills. The sub-flooring shall be cleaned sufficiently to reveal any holes in the subflooring.

11.4.2 Exterior

For the Power Car and Staff Cars the Railcar roof shall be cleaned including removal of stains. Any materials on the roof used to repair holes or cracks in the roof shall be removed to determine the extent of the holes or cracks.

Stains and any remaining paint shall be removed from the side and end frames.

The underframe shall be cleaned to remove dirt, oil, tar, and other debris so that the surface of the underframe members can be easily inspected. Excessive corrosion that may conceal cracks shall be removed by wire brushing or other effective means. All joints shall be cleaned. Such joints include floor beams and crossbearer attachments to side sills; bolster connection to side sills, center sill, and draft sills; and draft sills attachment to the end sill. All brackets shall be thoroughly cleaned.

11.5 INSPECTION

11.5.1 General

After the carbody has been thoroughly cleaned inside and out, a Contractor inspection of the interior and exterior of the Railcar shall be performed to detect corrosion, holes, cracks in welds and cracked or deformed structure (see Section 1.6.4). The method for locating defects shall be determined by the Contractor. Inspection for cracks by dye penetrant test shall be performed in all critical weld areas, any damaged areas, and any other suspect areas as determined by the Contractor. All inspections shall be performed with the PM representative in attendance. All defects and their location shall be recorded for later evaluation.

11.6 EVALUATION AND REQUIRED REPAIR

11.6.1 General

It shall be the responsibility of the Contractor to restore each carbody structure to meet the requirements of the Specifications. Any replacement structure required must be equal to, or greater than, the strength of the original structure. Also, replacement material, welding and fasteners must be at least equal in strength to that of the original material, welding and fasteners and applied in accordance with the requirements of the

Specifications. Ultradome structure strength shall be as determined by the design and FEA results.

11.6.2 Fasteners and Hardware

No fasteners shall be reused. All fasteners removed in the remanufacturing process shall be replaced with new fasteners. Fasteners shall be stainless steel except in applications where high strength carbon steel fasteners, plated to the requirements of Section 16.2, are required.

All non-stainless steel screens, clips, or other miscellaneous hardware and fittings in contact with or close proximity to stainless steel parts shall be removed and replaced with new stainless steel material of like configuration.

11.7 NEW STRUCTURE

11.7.1 Vestibule Partition

11.7.1.1 Doorway Design for ADA Requirements

The end doorway at both ends of the applicable Railcar shall be a minimum of 32 inches to allow for wheelchair passage. It shall be the responsibility of the Contractor to design the body end partition with adequate strength to meet the requirements of the Specifications.

11.8 STRUCTURAL ANALYSIS

11.8.1 General

For any damaged structure that must be replaced, the Contractor shall provide a structural analysis to show that the replaced structure is equal to or greater than the strength of the original structure. For new structure, such as new internal roof bows, new Railcar sideframes, new underframe equipment supports and the new body end doorway, one or more stress analyses shall be performed to demonstrate the adequacy of the structural design with the requirements of the Specifications.

11.8.2 Structural Connections

Rivets or bolts used in a connection shall not be considered as sharing the load in combination with welds. Welds, if used, shall be sufficient to carry the entire load in the connection. However, connections that are welded to one member and riveted or bolted to another member are permitted.

Structural welding shall be in accordance with applicable portions of Section 16.23.

11.8.3 Equipment Design Loads

The design loads for all underfloor and roof-mounted equipment, any portion of equipment boxes, equipment hangers, standby supports, safety hangers and any portions of the Railcar body structure to which these items are attached shall be determined by the Contractor. The direction of loading for the installed equipment will be determined using the Railcar body as the reference point. These loadings shall be applied separately, and may develop the ultimate load carrying capacity of the affected structure. In no case shall the strength of a fastener or the shearing of the fastener through the base material be the limit of the carrying capacity of a member.

11.8.4 Design Calculations

11.8.4.1 Equipment Supports

The Contractor shall perform stress analyses of any new equipment supports for equipment weighing over 200 pounds. The analysis shall include a sketch of the equipment and bracket layout with pertinent dimensions and loads.

Margins of safety (MS) shall be positive and as close to zero as possible. MS is defined as the allowable stress divided by the calculated stress less 1.00 for each loading condition. The calculated stress shall include the applicable load factors.

11.9 INSULATION

11.9.1 General

For the Power Car, Staff Cars and Spa Car the Contractor shall determine if the insulation now on the inside surfaces of the roof and side frame structures should be replaced. In those areas where new insulation is required, it shall be as described below or equal:

Exterior wall insulation shall be Enerok 1200-100 mineral wool board type insulation - 2" thick as manufactured by Bradford Enercon, Inc.

Pipe insulation shall be as manufactured by Johns Manville Co. Product name is Micro-Lok-One piece fiberglass insulation with vinyl cover style no. AP-T.

Upper level floor insulation shall be Enerok 1200-100 board type insulation installed to underside of floor.

Center aisle at upper level (dome) shall have 1" thick fiberglass board with reinforced foil face.

The materials used for insulation shall be at least as fire resistant as glass fiber insulation. The insulation and all material used for vibration damping shall meet the flammability and smoke emission requirements specified in Section 16.25. The insulation system described in this section represents minimum requirements, and may be increased by the Contractor if deemed necessary to do so.

11.10 FLOOR CONSTRUCTION

New floor where applicable shall be constructed of plymetal of the Contractor's proprietary design, which shall meet the requirements of Section 16.25. The panels shall be composed of exterior type, grade B-B or better, five-ply plywood, using resin-glued fir with solid and jointed cores and crossbands, faced on the entire top surface and on the bottom surface with 26 gage galvanized steel. The skins shall be securely bonded to the plywood.

New upper floor panels of the Contractor's proprietary design, similar in construction to the lower floor panels, but of ¾" thickness plymetal, shall be provided where required by the design.

New floor panels shall be made of pieces as large as possible, with transverse mortise and tendon joints located over structural members. Epoxy sealant between the joints and between the floor panels and the seat rails will be acceptable. All exposed edges of the panels, including openings for ducts and conduits, and joints between panels, shall be waterproofed and sealed at the time the panels are inspected.

The plymetal floor panels shall be attached to the floor structure using flat head fasteners in formed-countersunk holes in the upper skin of the plymetal floor panels.

11.11 FLOOR COVERING

11.11.1 General

Floor covering materials throughout the Railcars shall be as described in the applicable section of the Specifications or equal. The floor covering shall meet the requirements of Sections 16.9 and 16.25.

11.11.2 Adhesive

The type of adhesive used to bond the floor covering to the floor panels shall be that which is recommended by the manufacturer of the floor covering and shall comply with the requirements of the Specifications.

11.11.3 Preparation

Before applying the floor covering, all voids, fastener heads, and cracks between floor panels shall be filled and the floor made smooth.

11.11.4 End Finish

Where the floor covering reaches the end walls and partitions of the Railcar body, it shall be suitably finished with a trim strip.

At all door openings the floor covering shall join with and form a positively clamped seal with the threshold plates.

11.12 THRESHOLDS

11.12.1 Construction

The collision post doorway threshold plates shall be cleaned and all low carbon steel or missing screws shall be replaced with stainless steel screws.

The interface between the collision post threshold and the door shall be designed and constructed to prevent the entry of water between the threshold and the door while the Railcar is moving at normal service speeds under the environmental conditions listed in Section 2.5.2, as well as entry of water when the Railcar is subjected to the spray jets of the Railcar washing facility.

New body end door thresholds, where required, shall be designed to cover the width of the designed ADA-compliant door opening. The body end door threshold shall be of materials selected by the Contractor and suitable for their intended purpose. The body end door thresholds shall be designed to allow for easy egress by the elderly and handicapped.

The body end door threshold shall incorporate guides for the sliding door.

11.13 DOORS

11.13.1 Body End Doors

Where required, sliding, body end door assembly shall be provided at both ends of the Railcars. The new body end door shall meet the ADA requirements and provide a minimum of 32 inch clear opening for a wheelchair. The mock-up (see Section 1.2.5) shall be used to assist in the development of the ADA requirements for wheelchair passage and parking.

The body end doors shall be of the single leaf sliding type, hung from a door suspension track with a horizontal, operator mounted above the door. Cushioned door-open and closed stops shall be mounted to the Railcar body structure. The body end doors shall be arranged to slide into pockets in the walls.

The body end doors shall be of stainless steel construction with honeycomb core, not less than 1-1/4 inches thick, internally reinforced and joined into an integral unit by resistance welding. They shall be constructed of an ample gauge of stainless steel to provide proper strength and rigidity to sustain a concentrated load of 200 pounds applied perpendicularly to the plane of the door at the center of the front edge. Joints and edges shall be thoroughly sealed against moisture. Stainless steel reinforcements shall be provided internally for the attachments of all door hardware. Doors shall be vibration free. The exterior and interior surfaces of the doors shall have a brushed finish.

The body end doors shall be secured with satin-finished white bronze locks, as made by J.L. Howard Company, or equal.
The body end door shall be equipped with an door closing device. The door closer shall allow the door to be easily opened. When the door is released to start the closing action, the door closer shall slowly complete the closing cycle. The closing speed of the door shall be adjustable.

All entry doors shall have switches for locked open, closed or automatic operation and be equipped with safety devices to protect them from accidentally closing The door operators shall be capable of operating from the main air reservoir tank during emergencies or from the 12VDC emergency power.

In the Dining Car with Kitchen, two (2) full-height, bi-parting, swing-type doors shall be installed at both ends of the kitchen in addition to doors that the Contractor determines are required for the loading of supplies.

Other doors for the loading and/or discharge of baggage or other purposes may be provided by the Contractor in accordance with the detail design development.

Body end door design, construction, installation and operation shall comply with AAR and other applicable requirements.

11.13.2 Equipment/Electric Locker Doors

A set of hinged bi-parting or single panel doors to be selected by the Contractor shall be provided for each electric and equipment locker. Such doors shall be hinged and sized so that with the door can be opened approximately 90 degrees. These doors shall provide access to the equipment in the electric lockers.

A continuous, flush, stainless steel piano hinge shall be provided along the full length of one vertical edge of each door. Each door shall make contact, on all edges, with a continuous rubber seal when locked.

A flush cylindrical lock shall be installed on this door operable by the coach key. The bottom of each door shall be equipped with a slide latch similar to J.L. Howard latch No. 51-A or equal.

11.13.3 Hold Open Devices

Where they exist, the door hold open devices used for the vestibule side doors, trap doors and the collision post door shall be removed from the Railcar, cleaned and restored to their original condition or replaced.

11.14 SEATS

11.14.1 General

Contractor shall only provide seating which is securely fastened to the Railcar in compliance with the Specification. All seating designs must provide for proper securement to the Railcar.

11.14.2 Fabrics

Seat fabrics shall be transportation grade as selected by PM. All upholstery materials shall conform to the fire resistance and smoke emission requirements of the Specifications.

11.14.3 Construction

11.14.3.1 Seat Frame

Seat framing shall be constructed of sheet steel and/or formed steel or aluminum tubes and painted to match the approved color scheme. All structural tubing shall have ends plugged to preclude entry of vermin.

Any exposed back pans shall be constructed of formed carbon steel or aluminum, painted to match the seat frame. The back pans shall be recessed to provide for passenger's knee clearance and shall be covered with carpeting to match the interior color scheme.

The seat frames and their attachment to the carbody shall meet the strength requirements of the Specifications.

11.14.3.2 Cushions

11.14.3.2.1 Seat Cushion

The seat cushions shall be constructed of a fire-retardant, low-smoke, flexible foam. The foam shall be a minimum of 3 inches thick.

The desired ride comfort of the seat cushion assembly shall be the same as that of a 55 lb. density foam cushion. The foam cushion shall have an IFD value of 55, +5, -0. The seat cushions shall be secured to the seat frame through the use of an approved fastening system. The seat cushions shall be interchangeable with the seat cushions of any other like seat in the car.

11.14.3.2.2 Back Cushion

The back cushion shall be constructed of an fire-retardant, low-smoke, flexible foam cushion. The foam shall be a minimum of 2 inches thick.

The back cushions shall be secured to the seat frame through the use of an approved fastening system. The back cushions shall be interchangeable among all seats of the same design.

11.14.3.3 Seat Frame Attachment

The determination of the method of securing the seats to the car shall be the responsibility of the Contractor and shall insure that the seat attachment meets the strength requirements of the DOT.

11.14.3.4 Seat Strength Requirements

Seat frame construction including the attachments to the carbody shall be sufficient to withstand the stresses to be expected in normal service operations, without permanent deformation, but not less than the loads listed below:

- 330 lbs. per passenger uniformly distributed vertically downward on center of seat bottom cushion.
- 330 lbs. per passenger uniformly distributed vertically downward on the front edges of the seat cushion.
- 150 lbs. horizontally perpendicular to arm rests in both directions.
- 250 lbs. vertical downward on arm rests.

Seats shall be tested to confirm compliance with these requirements, and reports submitted.

11.15 UNISEX TOILETS

11.15.1 Standard Toilet

The standard toilet shall be constructed to the general plan as shown on Contract Drawing LTNG 10, where it is located immediately adjoining the stairwell.

The overall interior dimensions of the toilet will be approximately 36" wide by 50" long. There shall be one (1) 19" door opening. The door opening shall be equipped with one (1) outward opening door which shall be equipped with a sliding indicator lock.

The toilet room shall include a sink cabinet, which shall be equipped with the following:

1. One (1) Corian counter top
2. Sink of integrated Corian construction or Kohler Linea bowl
3. Delta spring return timer valve, dispensing warm water
4. Chicago faucet
5. Paper towel dispenser, mounted in counter surface, spring loaded type
6. Trash disposal opening in counter top
7. Trash can under counter
8. Plastic Laminate cabinet fronts with European style doors and hinges (color to be as selected by PM).

Mounted above the counter tops shall be a 27" mirror on the right and a 36" mirror of the left. Mirrors shall be fully adhered plate glass.

The toilet room shall be equipped with a Microphor air assisted flush, residential size bowl and a china toilet with flushing mechanism. There shall be a wall mounted purse shelf under which shall be mounted a two (2) roll toilet paper dispenser in chrome finish.

The toilet room shall be equipped with one (1) 100 watt, recessed incandescent light fixture (light fixture allowance $89), as well as, one (1) Puk light 12 volt quartz halogen emergency light attached to the emergency lighting circuit. The toilet room shall be equipped with an exhaust fan providing at least 20 CFM of exhaust whenever the car is supplied with head end power. The floor shall be covered with Loncoin sheet vinyl (color to be selected by PM) and trimmed in a 3" compatible color base cove. Loncoin flooring shall be applied according to manufacturer's instructions.

11.15.2 ADA Toilet

The ADA compliant public toilet shall be as shown on Contract Drawing LTNG 10, which is labeled ADA lavatory. The ADA lavatory shall contain all the features of the standard toilet plus the following:

1. Inside dimensions of approximately 80" by 36"
2. 39" sliding door, which is ADA compliant
3. Full compliance with ADA intercity train toilet regulations, as published in the Federal Register
4. Two (2) hand rails of approximately 1 1/4" diameter and measuring 38" and 16" respectively. Hand rails to be constructed of brushed stainless steel.
5. All operating hardware shall be ADA compliant

11.16 MOBILITY-IMPAIRED ACCOMMODATIONS

11.16.1 Wheelchair Area

Accessibility to the Railcars for mobility-impaired persons who use wheelchairs shall be provided through both the "A" and "B" end vestibule side and body end doors. Suitable wheelchair parking shall be provided. The parking area shall allow the wheelchair or mobility aid to be positioned parallel to the longitudinal centerline of the Railcars.

Each parking area shall have a clear floor area of at least 30 inches by 48 inches.

11.16.2 Wheelchair Bridgeplate

A lightweight, portable bridgeplate shall be provided to permit safe loading of wheelchair passengers from PM's handicapped station access platforms. The wheelchair bridgeplate shall be constructed of a lightweight material. It shall be designed to be securely fastened to the side door threshold while in use. The bridgeplate shall be large enough to accommodate a wheelchair and occupant, yet small and light enough to be handled by one crew member. The bridgeplate shall be firmly secured to eliminate any noise during Railcar operation. The bridgeplate shall be secured on the open platform Railcar.

The wheelchair bridgeplate shall be designed the meet the strength and configuration criteria of the ADA of 1990.

11.17 STAIRWAYS

Interior staircases shall be fabricated from LAHT steel with an all-welded construction. These staircases shall have non-skid stair treads of RCA non-skid rubber with ADA required color contrasting stripes on each tread edge.

11.18 HANDRAILS

Interior handrails and open platform handrails shall be fabricated from continuous-run stainless steel, type 304, weld where required and polished.

Interior stairway handrails shall be fitted to stairways at time of stairway fabrication to insure proper fit prior to the installation of the stairway(s).

Where glass panels are installed in handrails, they shall be secured by stainless steel clips welded to the handrail, and polished after installation.

All handrails, grab rails and foot rails at exterior of Railcar shall meet AAR and FRA specifications as to size and location.

An elevator style lift, primarily for use by handicapped passengers shall be installed in accordance with the Contract Drawings. The lift shall be a National Wheel-O-Vator Model BC-96 or equal, having a capacity of 750 lbs. and a manual lowering, Emergency Stop and alarm features.

11.19 INTERIOR WALLS, LININGS AND FINISHINGS

11.19.1 General

Wall coverings in the upper level (dome) and dining room areas shall be "B. Berger" reptile design - style no. A7720-30 or equivalent as selected by PM.

Stairway vertical walls shall be covered with corded acoustical wall covering. Color to be selected by PM

Unisex toilet room walls shall be plastic laminate; color to be selected by PM.

Fabrics, carpeting and wall covering quality similar to those used on Ultradome II are provided for in the Specifications. The allowance for wall coverings is $35 per yard, FOB Contractor's plant.

11.19.2 Interior Lining Installation

Interior linings shall be applied and fastened in accordance with the Contractor's design requirements. The mounting shall be designed to accommodate the dynamics of Railcar movement without transmitting stress to the liners.

"Anti-squeak" tape or full-bond adhesives shall be used between linings and any structure to which they are attached or with which they come in contact. Sufficient access to all apparatus mounted within the Railcar body shall be provided in the apparatus enclosure.

Exposed fasteners shall be used only for specific applications and the quantity of fasteners per application shall be kept to a minimum. Items on which exposed fasteners may be used include access panels, heater guards, coat hooks, and door hardware.

11.19.3 Sagging and Drumming

Where installed, all ceiling panels shall be adequately supported to prevent sagging and drumming. The ceiling panels and air diffusers shall be suitably supported by mechanical hangers fastened to the roof structure.

11.19.4 Light Fixture Supports

Lighting fixtures shall be supported as may be determined in the Contractor's design.

11.19.5 Ceilings

The upper level of the domed Railcars shall have aluminum paracube installed in the ceiling aisleway.

The dining room ceiling on the lower level shall be covered with washable vinyl covering with the material and color to be selected by PM.

Unisex toilet room ceilings shall be covered with vinyl covering.

Open platform ceiling shall be painted with Dupont Imron 5000 or equivalent.

Kitchen area ceilings shall be covered with stainless steel sheet metal.

11.19.6 Equipment/Electric Lockers

Equipment and electric lockers shall be built into Railcars as determined by the Contractor's design. Electric lockers shall be sized and placed so that the following equipment can be appropriately accommodated:

- Lighting Switch Panel
- General Circuit Breaker Panels
- Air Conditioning and Heating Circuit Breaker Panel
- PA and PEC Systems

11.20 GLAZING

11.20.1 FRA Certification

All glazing shall be in compliance with 49CFR part 223. Side facing glass shall be laminated safety glass, tested and certified by the manufacturer to be FRA Type II compliant per CFR 49 part 223, Appendix A. End facing glass shall be laminated safety glass, tested and certified by the manufacturer to be FRA Type I compliant per CFR 49 part 223, Appendix A.

All safety glass shall be marked with the FRA type (I or II), name of manufacturer and type or brand identification of the material. This permanent marking shall be preferably in the lower right hand corner, inside reading.

All side facing and end facing glass shall be tinted bronze with 52% visible light transmitting PVB inter layer. Where polycarbonate materials are utilized for glazing, they shall be of a materially equal tint and visible light transmittance and shall appear to be identical in color to the safety glass.

11.20.2 Optical Performance

11.20.2.1 Color

There shall be no more than ± 4% variation in light transmission, in sections having a particular tint, in the individual lights of laminate sheet glass when examined over a white background.

11.20.2.2 Specks and Scratches

Occasional specks of foreign material and scratches are permissible, provided such specks do not exceed 0.020 inch in greatest dimension and scratches do not exceed a total of 3 inches in length and neither are within the central three-quarter area of the lite.

11.20.2.3 Bond Separation

Lights that contain unbonded areas shall not be used.

11.20.3 Solar Performance

All safety glass shall have a total solar heat rejection substantially equal to the solar heat rejection as calculated for the lamination described below, using generally accepted thermal transfer finite element analysis software and the demonstrated solar rejection characteristics of each inter layer as provided and certified by the inter layer manufacturer. Such total solar heat rejection must account for the re-radiated heat of any heat absorbing inter layers or monolithic glass. Furthermore, the assumed state of the Railcar must be at rest, and hence approximately 55% of all absorbed heat shall be assumed to be re-radiated or convected into the Railcar's interior HVAC load. The lamination described below has a calculated total solar hear rejection of 64% through the tangent (vertical) leg and 70% through the non-tangent (horizontal) leg.

11.20.4 Lamination Construction

The construction of the safety glass laminate shall be as described below or of another construction, which shall yield substantially equal solar heat rejection, optical clarity, visible light transmittance and color, which shall have been certified to be in compliance with 49CFR part 223.

The following construction shall be used for laminated safety glass, FRA Type II, proceeding from exterior to interior surfaces.

3/16" clear float glass
.015" clear PVB
Southwall XIR, PET film
.015" bronze PVB (52% visible light transmittance)
3/16" clear float glass
.030 PVB (butt splice clear and bronze 52% as shown on drawings)
3/16" clear float glass

The following construction shall be used for FRA Type I (end facing) laminated safety glass, proceeding from exterior to interior surfaces.

1/4" clear float glass
.030" clear PVB
Southwall XIR, PET film
.030" bronze PVB (52% visible light transmittance)
3/16" clear float glass
.060 clear PVB
3/16" clear float glass

11.20.5 Edge Treatment and Seal

The overlap of one laminate of the lite with respect to another at an edge shall not exceed 1/16". All edges shall be free of burrs, sharp edges or other imperfections, which would cause stress concentrations in the edge of the glass. All edges shall be sealed with Essex Specialty Products, Betaseal #43523 or an equivalent product, which equivalency must be approved by Contractor. The edge seal shall be compatible with PVB, PET and Dow Corning 795 Silicone Sealant and shall be capable of withstanding moisture penetration for a period of ten years.

11.20.6 Glass Warranty

The glass manufacturer shall provide an assignable warranty for the laminated glass, warranting it to be free of defects in material or workmanship and guaranteeing that is shall not de-laminate nor discolor from moisture absorption for a period of ten years from the date of manufacture.

11.20.7 Dimensional Tolerance

Flat glass shall not have an out of flatness condition exceeding .045 inch per lineal foot, nor an overall width or height exceeding the Specifications by more that +- 1/8".

Bent glass shall conform to the reference standard curve provided by Contractor and shall not deviate from that curve at any point by more than 3/8", nor shall the overall dimension in width or girth exceed the specified dimensions by more then 3/8"

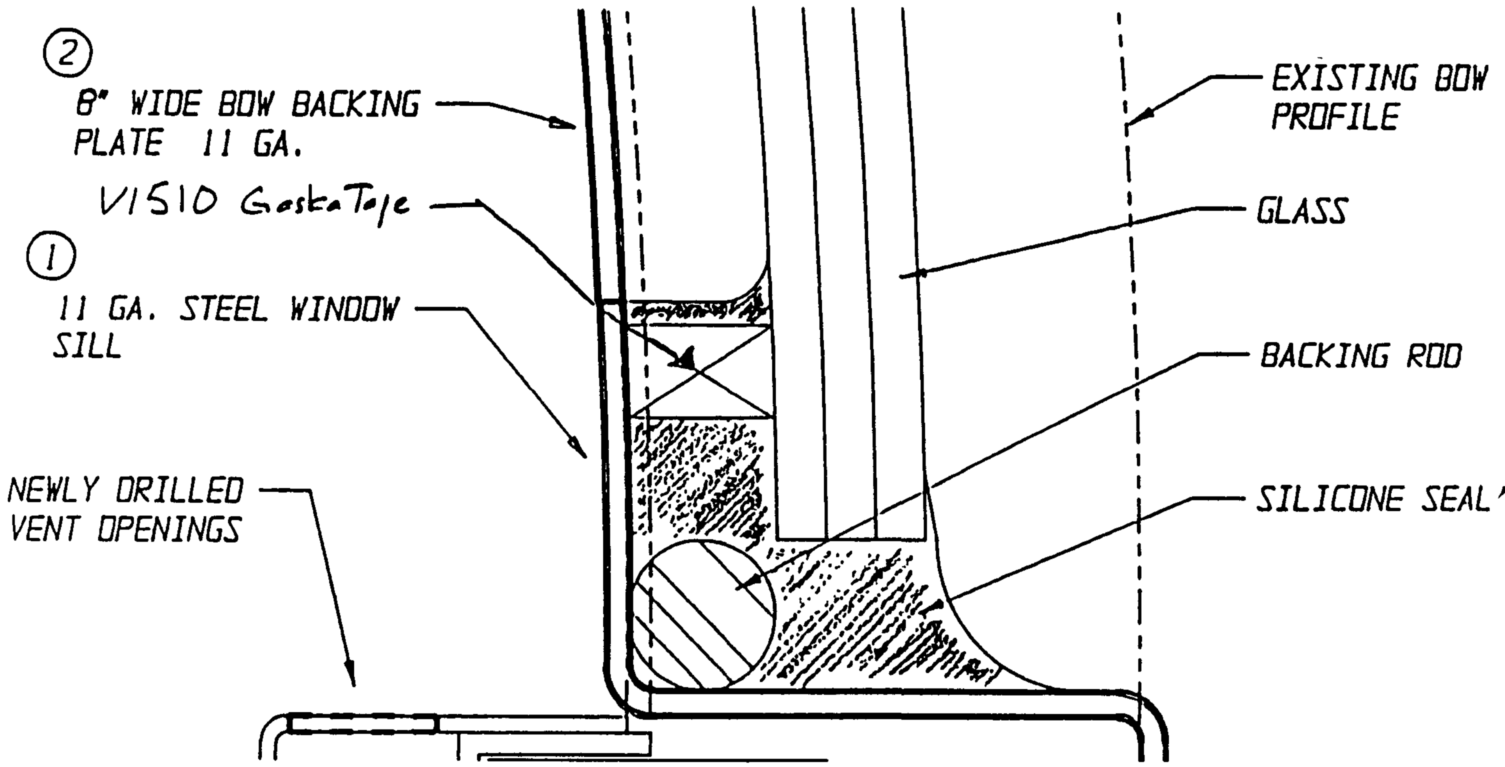
11.20.8 Glazing Method

11.20.8.1 Dome Glass

Dome glass shall be applied to the Railcar as per sketch #11-1 included herewith. The glass shall be fitted to the window opening using resilient setting blocks at the quarter points of the foot of the lite and resting the glass on Gaska Tape V1510, which shall have been previously applied to the circumference of the "bow backing plate" which plate provides the seat for the dome window glass.

The void between the V1510 and the glass shall then be filled with Dow Corning 795 Black Silicone based construction adhesive/sealant and shall be free of voids. A backing rod per sketch 11-1 shall be placed as shown and the remaining void filled with Dow Corning 795. The interface between the glass and the Sealant shall be tooled as shown in the glazing sketch on both the interior and exterior sides of the glass.

SKETCH 11-1
DOME GLASS GLAZING METHOD



- On the light panel, a clear anodized aluminum pull handle shall be securely fastened to the lite to facilitate removal of the window. The location and size of this handle shall be such that it is covered by the red pull handle. Silk-screened on the handle in 7/16 inch high black letters shall be the word "PULL".

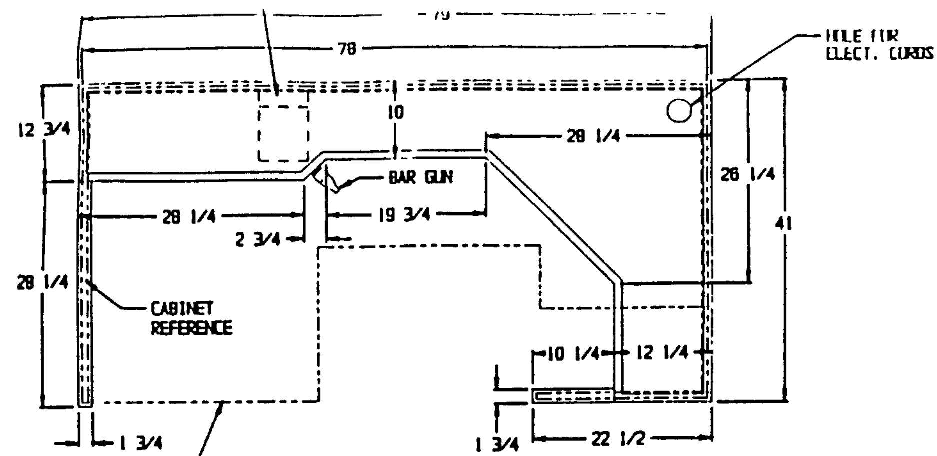
Emergency escape sash design installation and location shall be determined by the Contractor's design.

11.21 STANDARD SERVICE BAR

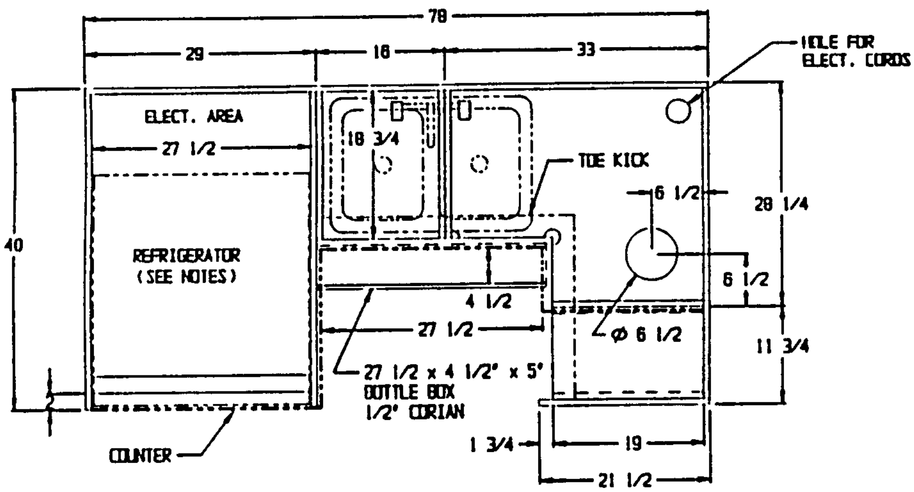
The Standard Service Bar shall be built according to drawing 041WS04, which is attached hereto. The bar shall include stainless steel sink, model 102-1, Delta single handle faucet, Delfield self contained 27" wide refrigerator with swinging stainless steel doors (not drawers).

A stainless steel liquor bottle box shall be mounted to the face of the cabinets in front of the sink. The vertical surface of the cabinet shall be covered in plastic laminate, color to be selected by PM. The horizontal surfaces shall be constructed of Corian, except for the coffee maker shelf. The service bar shall be equipped with 208 volt and 120 volt outlets. The 208 volt outlet shall be installed in the coffee area. There shall be two (2) 120 volt convenience outlets located in the bar, underneath the top shelf. The service bar shall be equipped with one (1) Bunn ST-F-20 coffee maker or equivalent.

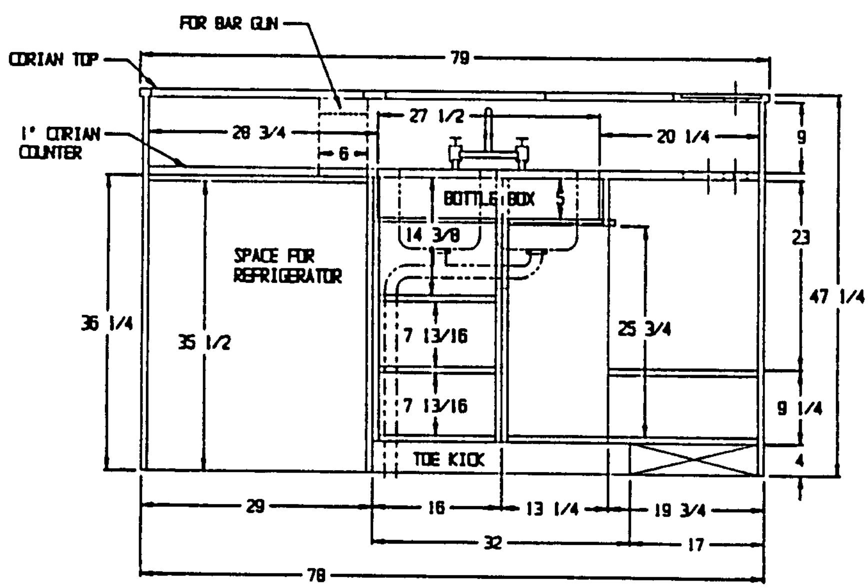
Where the service bar is not installed on the dome level, a back bar rising to ceiling height may be constructed at the option of PM to provide more storage.



PLAN
CORIAN BAR TOP



PLAN
CABINETS



ELEVATION

RADER RAILCAR INC. DENVER, COLORADO ph (303) 371.4955	CLIENT: TOUR ALASKA	
	UPPER LEVEL BAR CABINET LAYOUT	
DRAWN BY lb	DATE: 12 FEB 92	DRAWING NUMBER 041WS04 REV
APPROVED BY [illegible]	SCALE: 1"=1'-0"	FILE # 041WS04

LOCOMOTIVES (RAILCARS 1&2)
SECTION 12

12.1 GENERAL

The Agreement provides for the Contractor to perform only exterior cosmetic work to the PM supplied Locomotives. The cosmetic work includes the design, fabrication and installation of a Fiberglass Reinforced Plastic (FRP) or other material selected by the Contractor, exterior shell that is to provide a streamlined appearance to the Locomotives.

The Contractor shall us a suitable attachment method that shall take into account the exterior and structures of the existing Locomotives to be supplied by PM, the structural characteristics of the FRP and the static and dynamic loading on the effected components.

The Contractor shall prepare and paint the Locomotives' exterior shell in a color scheme to be selected by PM.

The Contractor shall perform an operational test of the Trainset, which includes the PM supplied Locomotives, as required in Section 4.4. Contractor responsibility with regard to the operational testing of the Locomotives as part of the Trainset shall be to conduct such Trainset operating and record the results therefrom.

No other Contractor responsible work is required on the PM supplied Locomotives or is included in the Baseline Work.

13.1 DIESEL GENERATOR SETS

Trainset Head End Power shall be provided by two diesel generator sets located in the Power Car. These diesel generator sets shall be capable of operating independently or in parallel.

The two (2) generator sets each consist of a Caterpillar Model #3508TA diesel engine, with 12VDC electric starting. These diesel generator prime movers are each directly coupled to an 820 KW-SR-4 Caterpillar supplied generator. These generator sets are skid mounted with a standard unit mounted radiators.

The generator sets are rated as follows:

(1) Kilowatt output 820 KW
(2) Voltage - 480 volts. - 3 phase
(3) K.V.A. rating - 960 K.V.A.
(4) Amperes - 1,155 amps.
(5) Power factor - .80 PF
(6) Frequency - 60 Hertz

The intake air system shall consist of an electrically operated louvered system which is activated automatically by starting the generator set. Each generator set has its own set of air intake louvers mounted on each side of the Power Car.

Each generator set shall be supplied with a radiator exhaust duct that directs the radiator fan airflow out of the front of the engine and upward towards the roof of the Power Car. At the top of the radiator exhaust duct is a bank of air duct silencers, which decreases the air flow noise passing through the roof of the Power Car.

The generator set combustion dual-exhaust system silencer system is mounted near the roof of the Power Car. This system consists of two (2) "critical" rated silencers and a diverter unit. One of the silencers is a "wet" silencer which is used when the heat recovery system is in use. The second silencer is used when heat recovery is not required. The diverter is used to switch from one unit to the other. The combustion exhaust system also is fitted with an air duct silencing bank.

Tanks for the carrying of make-up cooling water and diesel fuel are located under the Power Car. Provisions are made for the undercar carrying of spare parts and consumable engine products in compartments.

Diesel engines shall be provided with an automatic safety shutdown system to include:

(1) Engine overspeed
(2) High water temperature
(3) Low oil pressure
(4) Low radiator water level

Each diesel generator shall have the following instrumentation mounted in the generator set control panel in the Power Car.

(1) Engine temperature gauge
(2) Oil pressure gauge
(3) Frequency meter
(4) Voltage meter
(5) Engine start-stop buttons
(6) Engine tachometer

13.2 DIESEL GENERATOR SET FUEL SYSTEM

The generator fuel system is comprised of a CorTen steel tank(s) having fuel fill inlets located on both sides of the Power Car. The tanks(s) shall have a total capacity of 1500 gallons with two (2) Rochester fuel level gauges per tank installed. Fuel lines between the tanks and the diesel engines shall be fabricated from schedule 40 black iron pipe with brass body valves installed using NPT threaded connections as per the fuel system design.

Fuel transfer shall be accomplished using the diesel engine mounted fuel pumps.

13.3 GENERATOR SET FIRE EXTINGUISHER SYSTEM

The diesel/generator set shall be supplied with a suitable automatic fire extinguisher system to be designed by the Contractor which shall include a Jomar VTS Model fire extinguishing system, or equal, using NAF-SIII, a clean extinguishing agent that leaves no residue, produces no toxic fumes, and contains no CFC's.

The system shall include at least two (2) non-electrical, thermal sensors per generator set that are each capable of discharging the extinguishing agent within ten (10) seconds of thermal sensor reaching activation temperature. The installed system shall have a five (5) year, no leak limited warranty, be rechargeable and have easily readable pressure gauges.

STAFF CARS (CARS #4,5,&6)
SECTION 14

14.1 STAFF CARS (Railcars # 4, 5 & 6)

It shall be the responsibility of Contractor to procure three (3) single level Railcars of light weight construction to be utilized as Staff Cars. The three (3) Staff Cars shall accommodate a total of fifty-two (52) hotel staff. Accommodations for forty-four (44) of the staff shall be in one (1) or two (2) person units. Accommodations for eight (8) of the staff shall be in single units of a slightly larger size. The Staff Cars shall also include an area for dining, which shall be approximately 25' long and the full width of the Railcar. The Railcars may be constructed of either stainless steel or LAHT steel and shall be converted to smooth sides for compatibility and visual appearance with the rest of the train. The Staff Cars shall be designed to operate in the same environmental conditions as the balance of the Trainset and shall otherwise meet the general standards set for the entire Trainset.

The trucks, breaks, draft gear and railroad safety appliances shall all be reconditioned, or replaced as specified Sections 6, 7 and 8 of the Specifications. The Staff Cars shall meet all safety standards as set forth in the Specifications.

14.1 ROOMS

Rooms for forty-four (44) staff shall contain one (1) or two (2) beds, which beds shall be not less than 30" wide by 70" long and which shall be equipped with dual density foam mattresses. Room lighting shall be adequate to provide 25' candles of general lighting and 50' candles at the mirror. Each room shall contain a dressing mirror of fully adhered plate glass, which shall be not less than 18" wide by 24" high. Each room shall contain adequate drawer space and hanging storage for a five (5) day trip for the storage of uniforms and two (2) changes of personal clothing. Each room shall be provided with a lockable, inward swinging door.

Each of the twenty-two (22) person Railcars (Railcars #4 & #5) shall contain four (4) toilet units. Each toilet unit shall one (1) Microphor air assisted flush toilet with china bowl, one (1) sink unit with self closing hot and cold water valves and Chicago faucet, one (1) mirror of not less than 18" by 24" dimensions, an exhaust fan providing 10 cu. ft. per minute exhaust, inward opening door with indicating lock mechanism and a 100 watt light fixture, which can be ceiling or wall mounted.

14.2 SHOWERS

The twenty-two (22) persons Railcar (Railcars #4 & #5) shall be equipped with four (4) showers each. The shower shall measure approximately 30" wide and 40" deep and shall include low flow shower head, complete shower stall, shower curtain rod, changing bench approximately 14" long by 10" wide, clothing hooks and outward opening door. The shower shall be equipped with a single lever mixing valve, which is equipped with scald protection. The shower shall be equipped with one (1) wet location light fixture of at least 100 watts. The door shall be equipped with an indicating type lock.

Railcar #6 shall be equipped with not less than two (2) such showers as described above.

14.3 Dining Room/Day Room

Railcar #6 shall be equipped with a dining room/day room for the feeding and relaxation of the train staff. The day room shall be the full width of the Railcar and approximately 25' in length. It shall contain a 10' stainless steel counter with 15 cu. ft. of refrigeration mounted under counter. In addition there shall be an under counter dish washer (Blakesly or equivalent), a three (3) compartment stainless steel integral sink, 10' of stainless steel storage shelves for dishware and supplies, one (1) microwave (as specified in the kitchen), 208 and 120 volt outlets as required for equipment and convenience, tables and chairs for twenty-two (22) staff, 24" television with vcr, six (6) overhead speakers of the same quality of those being used in the passenger accommodations and other such features as are required to reasonably accommodate the staff for a five (5) day period.

Table surfaces shall be plastic laminate and chair coverings shall be industrial grade vinyl, both of which shall comply with the Specifications with respect to fire.

14.4 GLASS

Glass shall be replaced as required in accordance with Section 11.18.

14.5 HEAD END POWER

Railcars 4, 5 and 6 shall be equipped with Amtrak compatible 480 volt Head End Power and shall take their power from the HEP trainline. These Railcars shall be equipped with Amtrak compatible breakers and contactors sufficient to power the respective Railcar.

14.6 POTABLE WATER

The Railcar shall be equipped with a potable water pumping system, in compliance with Section 9 hereof. Each Railcar shall carry 1000 gallons of potable water in one (1) or more potable water tanks.

14.7 SEWAGE

Each Railcar shall be equipped with 300 gallons of (black) water storage in compliance with the general standard for sewage in Section 9 here of. (Gray water) shall be stored in the largest possible temporary storage tank and shall be dumped to rail while under way.

14.8 HEATING VENTILATION AND AIR CONDITIONING

The Staff Cars shall be retro fitted with a minimum of 20 tons of air conditioning in a split system configuration. They shall be further equipped with 50KW of electric heat to be provided in a combination of overhead heat elements and base board heating elements as required. All HVAC systems shall the general Specification for HVAC contained in Section 9 hereof.

14.9 PAINT

Railcars 4, 5 and 6 shall be painted in Imron 5000 with appropriate primers as specified by the manufacturer. The paint shall be applied in accordance with the specifications of the manufacturer. Color shall be as selected by PM. Railcars 4, 5 and 6 shall be smooth sided in appearance to be compatible with the smooth sided appearance of the balance of the Trainset.

14.10 TRUCKS, BRAKES, COUPLERS AND DRAFT GEAR

The trucks shall be overhauled in accordance with Section 7 of the Specifications. The couplers, draft gear, brakes and railroad safety appliances shall all be in compliance with applicable Sections of the Specifications.

SLEEPER CARS (CARS #7-14)
SECTION 15

15.1 STANDARD TWO PERSON STATEROOMS

Railcars 7 through 13 shall each contain 13 standard two person staterooms, with 6 on the upper level and 7 on the lower level. Railcar 14 shall contain 6 standard staterooms on the upper level and 5 on the lower level.

Standard staterooms shall be designed as per Contract Drawing LTNG 02 and shall contain the following features and equipment:

15.1.1 Beds

Two lower foldaway beds of overall dimensions of 32 inches by 80 inches. Each bed shall be equipped with a dual density foam mattress approximately 4 and one half inches thick. Foam shall comply with foam specifications regarding fire rating, smoke generated and toxicity of combustion products as defined elsewhere in the specifications.

One bed shall be stowed in the space between the back wall and the back of the couch. The other bed shall be stowed in the outboard wall under the large window. Both beds shall be equipped with mechanical guides and assists to enable either a passenger or steward to stow or deploy the bed. Beds shall be designed with a retainer strap with velcro attachments for securing the bedding and pillow in place when stowing the bed.

Bed shell shall be constructed of fiberglass reinforced plastic, composite, or reinforced aluminum and shall be designed to withstand the sitting and reclining force of a 330 lb. person including reasonably predictable shock loads imposed by said person.

Please note that bedding other than mattresses shall be provided by PM as part of PM's normal supplies.

15.1.2 Folding Table

A folding table approximately 22 inches by 25 inches shall be built into the bed shell, which stows under the large window. The table shall have a top surface of either Corian or a plastic laminate as selected by PM. It shall have a locking support arm, which will be easily released or locked by a passenger and which shall enable the table to support a load of 75 lbs. without folding downward.

15.1.3 Wardrobe Closets

The stateroom shall contain three wardrobe closets. Two closets shall be located directly over and behind the couch and shall be approximately 8 inches deep, 27 inches wide and 42 inches high. One closet shall be located outboard of the toilet against the wall and shall be approximately 18 inches deep, 24 inches wide and 42 inches high. All three closets shall have doors installed with European flush fit style cabinet hardware (Blum or equivalent) and positive locking flush push to release lock (Camlock or equivalent) in brass or chrome finish to be selected by PM. Each wardrobe closet shall contain a hanger rod secured perpendicularly to the back wall and with a plate on the outer end to prevent hangers from slipping off. The rod shall accommodate standard wire hangers and shall not require special hangers to be used.

Wardrobe doors shall be constructed of fire retardant materials in compliance with the Specifications and shall be finished on the exterior with fire treated oak wood veneer, finished with a two part polyurethane finish or with a plastic laminate or with other finish of equivalent cost to be selected by PM. For the provision of alternative door surfaces an allowance of $20 per square foot of surface area shall apply.

Closets shall be finish painted on the interior and shall be smooth and free of rough surfaces. Visible fasteners shall be permitted inside cabinets for the hanging of the cabinets to the stateroom bulkheads but the fasteners shall be smooth and not constitute a hazard to clothing hanging in the closet.

15.1.4 Bathroom

Each stateroom shall have a bathroom containing a shower and toilet. The shower shall have a low flow shower head (Waterpic, 1.5 gallon per minute or equivalent), shower curtain rod, single handle water control valve with included scald protection (Delta or equivalent) in chrome finish, grab rail (chrome or brushed stainless steel finish), toiletries shelf (self-draining), drain with debris proof drain strainer in chrome or brushed stainless steel finish, and 3 inch high formed drain pan to contain shower water.

The toilet shall be a Microphor brand full size white china toilet with compressed air assisted flush. Seat shall be selected by PM. All plumbing including water supply, air supply and waste line shall be installed as per Microphor installation specifications and instructions. Installation drawings shall be reviewed by Microphor before system is installed.

The shower and toilet enclosure shall be constructed of fiberglass reinforced plastic, aluminum faced hex cell panels, Corian faced hex cell panels or other mutually agreed materials which shall produce a high quality of finish consistent with the design parameters of this project. The enclosure shall have a unitized floor pan with drain so that either a shower overflow or toilet overflow condition shall drain to the waste water system and shall not drain into the space below the affected cabin. The toilet entry shall have an integral threshold which shall be approximately 1 inch high to contain overflows.

The bathroom unit entry door shall be constructed of aluminum or plastic laminate faced hex cell phenolic core, with aluminum or stainless steel edge caps. The interior finish shall be identical to or consistent with the interior finish of the toilet/shower module. The exterior finish shall be a full length mirror unless PM shall select a finish consistent with the wardrobe door finish. The mirror shall be a fully adhered plate glass mirror. Due to previous problems with tempered mirror quality we do not recommend tempered mirror. If an alternative finish is selected an allowance of $20 per square foot shall be allowed for the alternative finish. The door shall have positive locking latching hardware in chrome or satin finished stainless steel and shall be lockable from inside the toilet with provision for emergency unlocking from the exterior. The door shall end approximately 3\4 inch short of the threshold in order to provide for exhaust ventilation from the bathroom unit.

The bathroom unit shall contain a powered exhaust vent which shall expel not less than 10 cfm of air from the cabin at all times. The exhaust shall exit under the Railcar. The exhaust fan shall operate at all times that 480 volt power is applied to the Railcar and shall not be switchable from within the stateroom. The vent shall be covered with an aluminum grille which shall be etch primed and painted to match the interior of the bathroom unit. The bathroom unit shall also contain a wall mounted 100 watt incandescent fixture to provide light for the entire bath unit interior. The allowance for this fixture shall be $89. The light shall be switched from a wall mounted switch on the exterior of the bathroom unit.

The bathroom unit shall contain a wall mounted towel rack for folded fresh towels which shall be mounted above the toilet. The rack shall hold two bath towels, two hand towels, and two wash cloths. The rack shall be chrome or brushed finish stainless steel wire.

The bathroom unit flooring shall be of a non-slip type. In the shower portion, the shower pan shall include an integrated cast-in or molded-in non-slip surface. The toilet portion shall be a sheet vinyl as selected by PM with a materials allowance of $25 per sq.yd. The vinyl shall be installed with a compatible cove as specified by PM.

15.1.5 Sink Unit

Each stateroom shall contain a sink unit consisting of a sink cabinet integrally mounted to the bathroom unit, Kohler sink model Linea or equal, Chicago Faucet #40BA665 or equal, Chicago Faucet spring loaded and timed water valves #HDF2507 (one each for hot and cold water) or equal, Corian surface (or equivalent) with color as selected by PM, under-counter shelves for toiletries, doors concealing the under-counter shelves, and mirror above the counter with a chrome wire shelf for toiletries mounted either through the mirror or directly below it and on a Corian or equivalent backsplash. The top surface shall be surrounded on back and two sides with at least a 3 inch high integral Corian or equivalent backsplash. The front edge shall have an integral ship's edge which shall be at least 1\2 inch high and finished on the front as a rounded or bullnosed edge to prevent water from the counter surface from running onto the floor. At PM's option, the sink and counter top may be one integral fabricated Corian unit with Corian sink.

The sink cabinet doors shall be fabricated of base materials similar to the bathroom unit door. The exterior door finish shall be a plastic laminate of color to be selected by PM. Alternative materials allowance shall be $20 per sq.ft. Caution in the selection of materials for these doors is urged because they will be subjected to considerable wear from baggage and other scuffing. Wood would not wear well here. The cabinet shall have a clear toe kick space not less than 3 inches high and 3 inches deep. Cabinet doors shall be equipped with Camlock push to release locks identical to wardrobe door and identical Blum or equivalent European flush door hinges.

The sink shall be plumbed with a P-trap accessible from the under sink cabinet and a lever action drain plug. The sink low-flow fixtures shall be fed by 3\8 inch polyethylene pipe utilizing ___________quick connect fittings.

15.1.6 Couch and Chair

Each stateroom shall contain one five foot long couch and a single two foot wide chair opposite the couch. The couch and chair shall be constructed in accordance with the fire safety, foam and general seating standards contained in the general materials Specifications herein. The couch and chair shall be upholstered in fabric as selected by PM. Seating fabric allowance shall be $75 per lineal yd. for 52 inch wide fabric.

The couch shall be mounted on a metal base which shall allow clear storage area under the couch at least 12 inches high. The space under the outside window side of the couch shall be utilized for the HVAC system described below. The space under the hallway side of the couch and under the chair shall be utilized for luggage storage. The luggage storage areas shall be fitted with a floor mounted rail approximately 3\4 inch high whose purpose shall be to restrict the movement of luggage during normal train motion.

The backs of the couch and chair shall be equipped with folding hinges which shall allow the back to fold down upon the seat cushion to provide clearance for the bed to be deployed. A positive locking device (Adamsrite seat back lock or equivalent) shall secure the seat back in the upright position.

In keeping with good safety practices on moving vehicles, both the seat and the couch shall be fixed in position and mounted to the Railcar structure in accordance with DOT/FRA guidelines for seat securement.

15.1.7 Drawer Unit

Each stateroom shall have at the hallway end of the couch a drawer unit approximately 24 inches high, 15 inches wide and 23 inches front to back in dimension. The unit shall contain HVAC temperature controls, and sound system channel selector and volume controls in a panel on the unit front at the top. Below that shall be three drawers for passenger clothing and accessories. The drawers shall have positive stops to prevent the drawers from opening do to the motion of the train. The drawer fronts shall be finished as specified for the sink cabinet door fronts. The top shall be Corian or equivalent as selected by PM.

15.1.8 Stateroom Door

The stateroom entry door shall be a hinged door opening into the stateroom, shall be 1 inch to 1 and 1\4 inch thick, shall contain a window approximately 38 inches high and 20 inches wide of laminated safety glass (two ply glass and one .030 PVB inter layer) or tempered glass. Glass shall be clear float glass. The door shall be hinged on sink side jam.

The door shall be equipped with standard chrome finished latching hardware with a key entry system. Please note that this door configuration has been selected to allow for the PM desire to consider electronic key access to the staterooms. Our preliminary investigation indicates that the Ving Card electronic key system might be adaptable to this door configuration.

15.1.9 Stateroom Lighting

Each stateroom shall have general lighting provided by a low profile dimmable fluorescent two tube ceiling mounted fixture. The fixture shall be concealed by an aluminum parabolic diffuser or other such indirect concealment as shall be mutually agreed. Parabolic diffuser allowance shall be $105 per stateroom. Each fixture shall contain two 40 watt SP3500 tubes. In addition, each bed shall have a reading light which is accessible when the bed is deployed.

Lighting levels in the stateroom shall be in accordance with AAR lighting standards.

Emergency lighting shall be provided in the stateroom by a 12 volt D.C. Puk Light brand, 10 watt halogen bulb fixture. One fixture shall be mounted in the ceiling of the stateroom and one shall be mounted in the ceiling of the bathroom unit. The operation of these emergency lights in shall be in accordance with FRA standards and as described elsewhere in the Specifications.

15.1.10 Blinds and Curtains

Each stateroom shall be equipped with Duette brand blinds in a color to be selected by PM. The Duette blinds shall be installed on the stateroom door, on the two windows opening onto the hallway and on the large window in the Railcar exterior. The blinds shall be retained in an extruded aluminum track which shall be anodized or etch primed and painted to match the interior colors as selected by PM. While the color and degree of opacity shall be as selected by PM, please be advised that metallic finishes cannot be permitted on the exterior surface (next to the exterior glass) due to the possible impact on glass performance. The Duette blinds on the dome windows shall be fitted with special metal stiffeners to assure that they will not unduly sag across the window span. The stiffeners will be retained by the aluminum track and shall not impair the operation of the blinds. Only one set of blinds can be installed per window. Therefore one cannot install both "black out blinds" and "sheer blinds" in the same window opening.

15.1.11 Floor Covering

Stateroom floors shall be carpeted. Carpet which is compliant with the fire standards herein shall be laid over a compliant 3/16 carpet pad. Carpet shall be as selected by PM. Carpet allowance shall be $25 per sq. yd., FOB Rader Railcar, Denver.

15.1.12 Wall Covering

Wall coverings shall be as selected by PM in fire standard compliant vinyl or polys. Wall covering allowance shall be $35 per lineal yd., 52 inches wide.

15.1.13 Heat Detectors

Rate of rise heat detectors shall be installed in each stateroom. Each detector shall have and integral piezzo electric horn or shall be connected to one in each room. In addition, each detector shall be wired to a central indicator panel in each Railcar which shall indicate the number of the room or location of each heat detector, and shall sound a central Railcar alarm and display a red indicator light for each activated heat detector.

15.1.14 Stateroom Heating Ventilation and Air Conditioning

Each stateroom shall be equipped with its own heating, ventilation and air conditioning unit. Each unit shall contain filters, two speed blower fan, 3KW electric heat coil, 18000 Btu capacity direct expansion evaporator coil, expansion valve, air proving switch, over temperature protection cutouts, and electrical control and protection circuitry. In addition, each unit shall contain a hot water heat coil and controls for recovering heat from the "waste heat loop" which provides co-generation from the Power Car diesel generator waste heat.

The stateroom HVAC unit will draw makeup air from the conditioned air in the hallway through a duct in the stateroom side wall. This conditioned makeup air will be mixed with the return air from the stateroom and drawn through the return air filter and into the HVAC unit. Conditioned air will enter the stateroom through a duct at the base of the large window. Air flow will be controlled by a field adjustable three segment opposed blade damper (Reliable model #LFD0) installed in the duct. Air will exit the damper into an anodized aluminum pencil proof diffuser grille (Reliable model #LFD125).

A single thermostatic control will be installed in each room. It will allow passengers to set the desire temperature and to control fan speed subject to automatic overrides built into the controls. Passengers may select from high and low fan speeds. The system will recognize two stages of heat and two stages of cooling. In first stage heat, the waste heat loop hot water coil will be opened. In second stage heat the electric heat will be powered. In first stage cool the expansion valve will be opened and the fan speed set at low unless the passenger has selected high which will override the automatic fan speed. In second stage cool the fan will be automatically advanced to high speed.

The evaporator system will be connected to a remote condenser and compressor under the Railcar. Four condenser/compressor systems of 72000 Btu capacity each will support the stateroom air conditioning system. These systems shall all be interchangeable among Sleeper Cars and shall be produced with rapid change and service features including component exchange where practicable.

The stateroom HVAC shall be capable of maintaining the interior stateroom conditions within the general standards for HVAC delineated elsewhere in the Specifications.

15.1.15 Television, VCR and Communications

Each stateroom shall be equipped with a 12" television and integrated VHS standard video cassette player. Each such TV shall be connected to an RG59 coaxial cable which shall be pulled through all Railcars including the Power Car. Contractor shall provide the TV/Video Player, shall pull the cable, and shall provide suitable inter Railcar connectors for the RG59 coaxial cable. PM shall provide any required engineering, program source equipment, modulation equipment or other materials required to produce a program source and distribute it via the installed coaxial cable. In addition PM shall provide any VHS tapes required for use in the VHS players provided by Contractor under the Specifications.

Contractor shall provide a three channel audio panel, ceiling mounted speaker, volume control and program source selector switch in each stateroom. In addition, Contractor shall provide a three channel source in the power car. PM shall provide the required program tapes to provide audio to the Trainset.

15.1.16 120 Volt Convenience Outlets

Each stateroom shall have two GFI protected duplex convenience 120 VAC outlets on a single 15 amp circuit. One duplex outlet shall be mounted in the face of the sink cabinet directly below the front edge of the top. The other shall be mounted in the face of the drawer unit, direct below the top.

15.2 ADA COMPLIANT STATEROOMS

Railcar 14 shall have two staterooms designed for wheelchair or other disability access. These rooms shall be arranged as per Contract Drawing LTNG04.

15.2.1 Beds

Beds shall be as per Section 1.1.1 above except that they shall be arranged in an over and under configuration as per Contract Drawing LTNG04 and the bed along the transverse bulkhead shall be stowed above the back of the couch as shown in the same drawing.

15.2.2 Folding Table

Folding table shall be as per Section 15.1.2 above.

15.2.3 Wardrobe Closets

ADA compliant staterooms shall have one hanging wardrobe closet with overall dimensions of 30 inches front to back, 9 inches wide and 60 inches high. All finish shall be as per Section 15.1.3 above.

15.2.4 Bathroom Unit

ADA compliant staterooms shall have a bathroom unit designed as per Contract Drawing LTNG04 which shall include Microphor toilet per Section 15.1.4 above. Handrails shall be installed per the Americans with Disabilities Act regulations for intercity train Railcars. Sink unit shall be installed within the bathroom unit and shall meet underside clearance as specified for ADA. Sink construction shall be of either stainless steel or fabricated Corian. All faucets, valves and shower head shall be as specified in Section 15.1.4 above. Shower shall be constructed with a fold down seat of brush finished stainless steel which shall be retained in the up position by a positive catch. The bathroom unit entry door shall be a sliding door suspended on roller bearing trucks (Adamsrite or equivalent) with ADA compliant lever type locking hardware which shall be lockable from inside the toilet unit and unlockable from the exterior in case of emergency.

The shower base shall slope toward a corner drain under the shower head. There shall be a slight raised edge which shall be wheelchair passable which shall define the edge of the shower unit but there shall be no shower curb. Shower curtain rod shall be installed.

In all other respects the bathroom unit shall meet the requirements set forth in Section 15.1.4 above.

15.2.5 Sink Unit

There shall not be a self-contained sink unit in the ADA staterooms except as defined in 15.2.4 above.

15.2.6 Couch and Chair

The arrangement of the couch and chair shall be as shown in Contract Drawing LTNG04. The couch and chair shall be as per Section 15.1.6 above except that the cushions shall be removable so that the longitudinal bed may be deployed using the couch and chair cushion bases as a bed base, and so that transverse bed may be deployed above the longitudinal bed in an over and under fashion. The removable cushions shall be securely fastened with spring clips. The longitudinal bed will require the services of a steward for make-up. The transverse bed shall be provided with mechanical assist so that the bed may be lowered by a passenger after the removal of the back cushions of the couch.

15.2.7 Drawer Unit

The ADA staterooms shall contain a drawer unit which shall be as per Section 15.1.7 above except that it shall be approximately 32 inches high and shall contain 4 drawers in addition to the control panel specified in Section 15.1.7 above.

15.2.8 Stateroom Entry Door

The stateroom entry door shall be a sliding door with ADA compliant lever type locking hardware. The clear doorway opening shall be 39 inches. In all other respects the door shall comply with Section 15.1.8 above. Please note that it may not be practical to install an electronic keyless entry on the two ADA stateroom entry doors.

15.2.9 Lighting

ADA stateroom lighting shall be as per Section 15.1.9 above.

15.2.10 Blinds and Curtains

ADA stateroom blinds shall be installed per Section 15.1.10 above except that the blind for the sliding door shall be mounted in a fixed position above the sliding door opening and shall be equipped with a fastening device at the foot to secure the blind against rattling and swaying while underway.

15.2.11 Floor Covering

The ADA stateroom floor shall be carpeted as per Section 15.1.11 above.

15.2.12 Wall Covering

ADA stateroom wall coverings shall be as per Section 15.1.12 above.

15.2.13 Heat Detectors

ADA staterooms shall have heat detectors installed as per Section 15.1.13 above.

15.2.14 Heating, Ventilation and Air Conditioning

ADA staterooms shall comply with Section 15.1.14 above.

15.2.15 Television, VCR and Communications

ADA staterooms shall comply with Section 15.1.15 above.

15.2.16 120 Volt Convenience Outlets

Each ADA stateroom shall have two GFI protected duplex convenience 120 VAC outlets on a single 15 amp circuit. One duplex outlet shall be mounted in the wall above and to the left of the sink in the bathroom unit. The other shall be mounted in the face of the drawer unit, directly below the top.

15.3 SUPERIOR GRADE STATEROOMS

Railcars 7 through 13 shall each contain one superior grade stateroom. The superior grade stateroom is located on the upper level at the B end. Superior grade stateroom shall be designed as per Contract Drawing LTNG 01 and shall contain the following features and equipment.

15.3.1 Beds

Beds shall comply with Specifications Section 15.1.1 above.

15.3.2 Folding Table

Folding table shall comply with Section 15.1.2 above.

15.3.3 Wardrobe Closets

The superior grade stateroom shall contain three wardrobe closets. Two closets shall be located directly over and behind the couch and shall be approximately 8" deep, 27" wide and 42" high. One closet shall be located behind the sink unit and against the bulk head of the adjoining cabin. This closet shall be approximately 15" wide, 72" high and 24" deep and shall contain a four drawer unit, approximately 24" high. All three closets shall comply in construction and finish with Specifications Section 15.3.3 above.

15.3.4 Bathroom Unit

Each stateroom shall have a bathroom unit, which shall be constructed in accordance with Section 15.1.4 above.

15.3.5 Sink Unit

Each stateroom shall contain a sink unit, which shall comply with Specifications Section 15.1.5 above.

15.3.6 Couch and Chairs

Each stateroom shall contain one, 5' long couch and two, 2' wide chairs. The couch and chairs shall be constructed in accordance with Specifications Section 15.1.6 above.

The couch shall be mounted on a metal base, which shall allow clear storage area underneath the couch, at least 12" high. This space under the exterior widow side of the couch shall be utilized for the HVAC system. The space at the opposite end of the couch shall be utilized for luggage storage. In addition, luggage storage shall be provided under the two chairs. The luggage storage area shall be fitted with a floor mounted rail approximately 3/4" high, whose purpose shall be to restrict the movement of luggage during normal train motion.

In all other respects the couch and chairs shall be in compliance with Section 15.1.6 above.

15.3.7 Drawer Unit

See Section 15.3.3.

15.3.8 Stateroom Door

The stateroom entry door shall be a hinged door entering into the hallway, shall be 1" to 1 1/4" thick, shall not contain a window and shall be hinged on the bulk head wall side.

In all other respects, the stateroom door shall comply with Specifications Section 15.1.8 above.

15.3.9 Stateroom Lighting

Superior stateroom lighting shall comply with Specifications Section 15.1.9 above.

15.3.10 Blinds and Curtains

Each superior stateroom shall be equipped with Duette brand blinds in a color to be selected by P.M. The Duette blinds shall be installed on the two, domed windows. The blinds shall be retained in the extruded aluminum track and shall, in all other manner, be installed in compliance with Specifications Section 15.1.10 above.

15.3.11 Floor Covering

Superior stateroom floors shall comply with Specifications Section 15.1.11 above.

15.3.12 Wall Covering

Superior stateroom wall covering shall comply with Specifications Section 15.1.12 above.

15.3.13 Heat Detectors

Superior stateroom heat detectors shall comply with Section 15.1.13 above.

15.3.14 Heating Ventilation and Air Conditioning

Each superior stateroom shall be equipped with its own heating ventilation and air conditioning unit. Each unit shall contain filters, two speed blower fan, 6KW electric heat coil, 27,000 Btu capacity direct expansion evaporator coil, expansion valve, air proving switch, over temperature protection cut outs and electrical control and protection circuitry. In addition each unit shall contain a hot water heat coil and controls for recovering heat from the "waste heat loop", which provides co-generation from Power Car diesel generator waste heat.

The stateroom HVAC unit will draw make-up air from the conditioned air in the hallway, through a baffled duct in the stateroom door. In all other respects, the superior stateroom heating ventilation and air conditioning shall comply with Specifications Section 15.1.14 above.

15.3.15 Television, VCR and Communications

Each superior stateroom shall comply with Specifications Section 15.1.15 above.

15.3.16 120 Volt Convenience Outlets

Each stateroom shall have two GFI protected duplex convenience 120 VAC outlets on a single 15 amp circuit. One duplex outlet shall be located in the face on the sink cabinet, directly below the front edge of the top. The other shall be mounted in the side wall in front of the couch.

15.4 DELUXE TWO PERSON STATEROOMS

Railcars 7 through 13 shall each contain one deluxe stateroom, which is located on the upper level, B end.

Deluxe staterooms shall be designed as per Contract Drawing LTNG 01 and shall contain the following features and equipment.

15.4.1 Beds

Two lower fold away beds with overall dimensions of 32" by 80". Each bed shall be equipped with a dual density foam mattress, approximately 4 1/2" thick. Foam shall comply with foam specifications regarding fire rating, smoke generated, intoxicants of combustion products, as defined elsewhere in the Specifications.

The beds shall be stowed in the side walls. The beds shall be equipped with mechanical guides in the cyst and designed for stewards to stow or deploy the bed. The beds shall be designed with a retainer strap, with velcro attachments, for securing the bedding and pillow in place when stowing the bed.

The beds shell shall be constructed as per Specifications Section 15.1.1 above.

15.4.2 Folding Table

A folding table constructed in conformance with Specifications Section 15.1.2 above, shall be built into the bed shell on the right hand side.

15.4.3 Wardrobe Closets

The stateroom shall contain three wardrobe closets. Two closets shall be located in the interior bulk head wall and shall be approximately 8" deep, 27" wide and 60" high. One closet shall be located in the dressing room area and shall be approximately 24" wide, 24" deep and 72" high. A four drawer storage unit shall be located at the bottom of this dressing room closet. It shall be approximately 24" high.

Wardrobe closet construction and finish shall be in compliance with Specifications Section 15.1.3 above.

15.4.4 Bathroom Unit

Each deluxe stateroom shall have a dressing room containing a separate toilet and sink unit and bath tub unit. The toilet unit shall contain a Microphor brand, full size white china toilet, with compressed air assisted flush. Seat shall be as selected by P.M. The toilet unit shall also contain a sink cabinet integrally mounted to the toilet room wall, containing a Kohler - Virteous China sink #P/N-K2217 "Linia" or equivalent, Chicago facet # 749A-665 or equivalent. Cabinet top shall be Corian surfaced (or equivalent) with color as selected by P.M., under counter shelves for toiletry, doors concealing under counter shelves and mirror on two wall above the counter. There shall also be a wall mounted chrome wire shelf for toiletries. The top surface shall be surrounded on two sides by a back splash, at least 3" high and constructed of Corian. The front edge of the top shell have intricate ship's edge, which shall be designed to prevent water from the counter surface from running on to the floor. At P.M.'s option, the sink and counter top may be one integral fabricated Corian unit with Corian sink.

The sink cabinet doors shall be fabricated in accordance with Section 15.1.5 above. The toilet unit shall contain a powered exhaust vent, which shall expel not less than 10 cfm of air from toilet unit at all times. The toilet unit shall contain a wall mounted 100 watt incandescent fixture to provide light for the entire unit interior. The allowance for this fixture shall be

$89. The light shall be switched form a wall mounted switch on the exterior toilet unit. The toilet unit shall contain a wall mounted towel bar for towel, which shall be mounted to the right of the sink unit and shall be adequate to contain, two hand towels and two wash clothes. The toilet unit shall contain a sliding door with overhead ball bearing trucks. In all other respects the toilet unit doors shall be constructed in accordance with the doors specified in Specifications Section 15.1.4 above. Toilet unit flooring shall be a sheet vinyl with 3" cove as selected by P.M.

The sink unit in the dressing area shall be constructed in accordance with Specifications Section 15.1.5 above.

A 100 watt incandescent fixture shall be wall mounted above the sink mirror. The allowance for this fixture shall be $89. The light shall be switched from a wall mounted switch on the left side of the sink mounted in the wardrobe closet wall. The dressing area shall be equipped with a privacy curtain to be constructed of fabric to be selected by P.M. The allowance for this curtain shall be $200.

The dressing room unit shall contain a 5' fiberglass tub and shower enclosure with integral sliding opaque safety glass door. The installation of plumbing and fixtures shall be in compliance Specifications Section 15.1.4 above. There shall be, mounted on the wall opposite the shower head, a towel rack for folded fresh towels which shall be capable of accommodating two bath towels, two hand towels and two wash clothes. The rack shall be chrome or brushed finish stainless steel wire.

15.4.5 Sink Unit

The sink unit for the deluxe stateroom is contained in the dressing room/bathroom unit described in 15.4.5 above.

15.4.6 Couch and Chairs

Each deluxe stateroom shall contain one, 6' long couch, two, 2' wide chairs and one, center table between the two chairs, which shall also serve as a drawer unit. The couch shall be placed on the wall nearest the stateroom door. The two chairs with the center table shall be placed on the wall opposite the couch. In all other respects the couch and chairs shall be constructed in accordance with Specifications Section 15.1.6 above.

15.4.7 Drawer Unit

The drawer unit shall be place between the two chairs and shall in all other respects comply with Specifications Section 15.1.7 above.

15.4.8 Stateroom Door

The stateroom entry door shall be a hinged door opening into the hallway, shall be 1" to 1 1/4" thick, shall not contain a window and shall be hinged on the hallway bulkhead jam.

15.4.9 Stateroom Lighting

Each deluxe stateroom shall have general lighting provided by low profile dimmable florescent two tube ceiling mounted fixture. This fixture and stateroom lighting shall in all manner comply with Specifications Section 15.1.9 above.

15.4.10 Blinds and Curtains

Each deluxe stateroom shall be equipped with Duette brand blinds and a color to selected by P.M. The Duette blinds shall be installed on the stateroom dome windows in accordance with Specifications Section 15.1.10 above.

15.4.11 Floor Covering

The deluxe stateroom floors shall be carpeted and the carpet shall be continuous into the dressing area. Carpet shall be in compliance with Specifications Section 15.1.11 above.

15.4.12 Wall Covering

The wall covering shall be as per Specifications Section 15.1.12 above.

15.4.13 Heat Detectors

Heat detectors shall be as per Specifications Section 15.1.13 above.

15.4.14 Heating Ventilation and Air Conditioning

Each deluxe stateroom shall be equipped with its own heating ventilation and air conditioning unit. Each unit shall contain filters two speed blower fan, 6KW electric heat coil, 27,000 Btu capacity direct expansion evaporator coil, expansion valve, air proving switch, over temperature circuits and electrical control and protection circuitry. In addition each unit shall a hot water heat coil and controls for recovering heat from the "waste water heat loop", which provides co-generation from Power Car diesel generator waste heat.

In all other respects the HVAC for the deluxe stateroom shall comply with Specifications Section 15.1.14 above.

15.4.15 Television, VCR and Communications

Each deluxe stateroom shall be equipped with television, VCR and communications as per Specifications Section 15.1.15 above. The TV/Video player shall be installed in the bulkhead wall facing the dressing room unit.

15.4.16 120 Volt Convenience Outlets

Each deluxe stateroom shall have GFI protected duplex convenience 120 VAC outlets on a single 15 amp circuit. One duplex outlet shall be mounted in the wardrobe closet, above the sink unit and to the left. A second duplex outlet shall be mounted in the face of the drawer unit, directly below the top. A third duplex outlet shall be mounted in the bulkhead wall of the toilet unit above and to the right of the sink.

DINING CARS (CARS #15 & 16)
SECTION 16

16.1 DOME DINING RAILCAR WITH KITCHEN #15

Dome diner (railcar # 15) will be built according to Contract Drawing LTNG 06.

16.1.1 Dome Level

16.1.1.1 Seating

Dome diner (railcar #15) shall contain 62 seats in two seating areas. 48 seats shall be arranged in the stairwell end and 14 seats in the service area end. Seats shall be constructed in compliance with the general seating specifications, including fire retardant foams and compliant fabrics. Seat cushions shall approximately 25" in width and seats shall be arranged on 78" centers. Where two sets of seats are arranged back to back there shall be a drawer between seats measuring approximately 14" wide and 10 " high. The door shall be equipped with a pull handle and a keyed cabinet latch. The drawer shall be constructed of stainless steel and shall ride on UHMW slides attached to the seat frame. There shall be approximately 16 such drawers in this Railcar. The seating shall be arranged in 10 groups of 4 and 11 groups of 2 for a total seating capacity of 62 seats.

16.1.1.2 Tables

There shall be a total of 22 tables. 10 tables shall be 4 persons and shall have approximate dimensions of 29" wide by 48" long. 11 tables for 2 persons shall have approximate dimensions of 29" wide by 26" long. All tables shall be constructed of Corian or Plastic Laminate (fire retardant) laminated to fire treated interior cabinet grade plywood. Tables shall be attached to the wall by means of a steel angle table bracket and the bracket shall be through bolted into the structural wall. The aisle end of the table, shall be supported by a single 1" steel tube leg with chrome finish.

16.1.1.3 Waiters Service Area

There shall be a waiters service area as shown on Contract Drawing LTNG 06. The waiters service area shall contain two dumb waiters approximately 24" wide and 16" front to back. These dumb waiters shall penetrate to the kitchen below. One shall serve as clean service the other as dirty. Additionally the waiter service area shall contain a Bunn Coffee maker model STF20, an ice and water station (Atlas Metal Industries WSB-15), a sink, cabinets and shelving of stainless steel and recessed florescent lighting sufficient to produce 50 foot candles of light at the work surface 36" above the floor. Bi-parting swinging service doors with 6" by 6" glass windows shall be installed in the service area at each aisle interface. The waiters service area shall be plumbed for hot and cold water and the sink shall be serviced with a Delta single handle mixing faucet in chrome finish.

16.1.1.4 Wait Station

There shall be two wait stations installed and located per Contract Drawing LTNG 06. The wait station shall be approximately 31" wide and 29" deep. Each station shall contain two drawers for silverware storage, a counter for miscellaneous use approximately 40" above the floor, over head storage for cups, saucers and glassware. The wait station shall be constructed of Stainless steel and shall be finished on the exterior as selected by P.M.

16.1.1.5 Pass Through to Adjoining Railcar

There shall be a single automatic sliding door at the end of the Railcar near the service area, which shall join this Railcar, at the upper level, to Railcar # 16. There shall be no such door at the opposite or stairwell end of the Railcar.

16.1.1.6 Lighting

The entire dome level shall be lighted by 4' florescent fixtures, concealed behind an aluminum paracube lighting diffuser. Railcar lighting shall be capable of being dimmed from a single Lutron dimming switch, located in the waiter service area. The florescent fixtures shall be equipped with electronic dimmable ballast, SP3500 40 watt bulbs and bulb locking devices. Emergency lighting provided by 12 volt halogen fixtures concealed behind a paracube shall be installed and shall provide light level in accordance with the AAR general specifications for emergency lighting.

16.1.1.7 Carpet

The dining room shall be carpeted in a carpet which is compliant with the AAR general specification on carpet, including fire rating.

16.1.1.8 Stairwell

The Railcar shall be equipped with a single standard stairwell joining the upper level and lower level of the Railcar, in accordance with the Specifications requirements on stairwell construction.

16.1.1.9 Music and Public Address System

The Railcar shall be equipped with 10 public address system speakers with high quality audio outlet and in accordance with the Specifications on communications. Volume control shall be located in the waiters service area and shall be divided among the large 48 seat seating area and the small 14 seat seating area, each area having a separate volume control. This railcar shall contain an amplifier, capable of providing the necessary audio amplification shall be installed in the Railcar. The Railcar shall not be equipped with its own audio source but shall be able to select one of the three channels offered throughout the Trainset.

16.1.2 Lower Level

The lower level of this dome dining Railcar (Railcar #15) shall primarily have a kitchen capable of providing three meals per day when this Trainset is fully occupied with 240 guests. The kitchen shall be designed to the applicable requirements of the United States Public Health Service and the FDA. A final layout and design of the kitchen shall be prepared by the Contractor and submitted to PM for its review before construction commences.

16.1.2.1 Kitchen Equipment

All kitchen counters and cabinets shall be type 304 stainless steel with a brushed or #3 finish. All stainless steel drawers shall be roller mounted and removable and shall accommodate a standard pan. Drawers shall be equipped with a detente, to keep drawers from opening while this Railcar is underway.

A) Kitchen layout and equipment shall be subject to final design and Approved by PM.

B) Preliminary equipment selection is subject to final designs. Selections are as follows:

(a)	(40 cu.ft.)	Utility CHF-3S Counter-high Freezer
(b)	(20 cu. ft.)	Utility CHR-3S Counter-high Refrigerator
(c)	(84 cu.ft.)	Utility 90-R-3S Reach-in Refrigerator
(d)	(84 cu.ft.)	Utility 90-F-3S Reach-in Freezer
(e)	(1)	Bunn ST-F-20 Coffee Maker
(f)	(1)	Wells RW-1 Bun Warmer
(g)	(1)	Hobart CN901 Convection Oven
(h)	(1)	Panasonic NE-1780 Microwave
(i)	(1)	Alto-Sham 1000TH -II split holding oven
(j)	(2)	Wells H-107 Hot Plates
(k)	(1)	Wells G-136 Griddle
(l)	(1)	Blakeslee VC-1 Dishwasher
(m)	(1)	Coates LS461Z Hot Water Heater
(n)	(1)	Wells Steam table
(o)	(1)	Wells Broiler

(p)	(1)	Custom built Stainless Steel exhaust hood with
(q)	(1)	Custom built Stainless Steel steam exhaust hood
(r)	(2)	EBM 1500 CFM Exhaust fans
(s)	(1)	A Garbage Disposal unit
(t)	(2)	Hatco 48" Food Warmer
(u)	(1)	T&S Brass Bronze Works B112 Pre-rinse faucet assembly.
(v)	(1)	T&S B250&B-199-I Double pantry faucet assembly
(w)	(2)	T&S B320 w/non splash Deck Mixing faucet assembly
(x)	(60 ft)	Stainless Steel counter, including one scrap sink, two pot sinks, one hand sink and two vegetable sinks. Integrally installed in the Stainless counter top.
(y)	(20)	60" Stainless Steel drawers mounted under counter, including standard pans.
(z)	(40 ft)	Stainless Steel shelving above and below counters
(aa)	(16)	24" wide by 30" tall Stainless Steel cabinet doors for dry storage areas
(bb)	(1)	Kold-Draft Ice Maker, model # GB603A with nominal capacity of 570lbs per day of cubed ice.

16.1.2.2 Flooring

The kitchen floor shall be a continuously welded stainless steel pan with 2" coves rising behind the walls. All equipment shall then be placed inside the stainless steel pan. The floor pan shall contain not less than four floor drains, which shall be sealed during normal Railcar operations and shall be unplugged for Railcar cleaning. The kitchen floor shall include a gasketed watertight access cover, to be installed over the truck center pins for access to the truck center pins. The kitchen floor shall be covered with a removable non-slip rubber kitchen matting.

16.1.2.3 Access Door

The kitchen shall be provided with not less than one exterior access door for the loading of supplies and the removal of kitchen floor mats for cleaning. This water tight lockable door shall have net cleared dimensions of not less than 26" high and 30" wide.

16.1.2.4 Lighting

The kitchen shall be equipped with ceiling mounted florescent fixtures rated for damp locations and enclosed in gasketed polycarbonate fixtures. The lighting shall provide not less than 50 foot candles at all work surfaces measured at the aisle edge of the counter approximately 36" above the floor.

Emergency lighting shall be provided in the kitchen area in accordance AAR emergency lighting standards by 12 volt halogen fixtures.

16.1.2.5 HVAC

The installed HVAC system shall provide for a negative air pressure in the kitchen relative to the rest of the Railcar in order to insure that kitchen air does not escape into the rest of the Railcar. The kitchen shall be equipped with its own five ton air conditioning system, which shall be controlled from within the kitchen. The make-up air system for the kitchen shall provide an adjustable damper which shall be operable from zero make-up air to 100%. The make-up air system shall be capable of providing clean filtered exterior make-up air equal to that being exhausted by the cooking line hood and the steam hood.

16.1.2.6 Hallway

The kitchen shall be surrounded by a hallway joining the two ends of the Railcar and being not less than 32" wide in compliance with ADA specifications access. The lighting, wall covering and floor surfaces in the hallway shall be in accordance with the requirements of the Specifications Section 11 on hallways.

16.1.2.7 Doors

Automatic doors shall be provided at each end of the lower level and shall be accordance with the Specifications Section 11 on entry doors.

16.2 DOME DINER WITHOUT KITCHEN RAILCAR #16

The dome diner without kitchen shall be built according to Contract Drawing LTNG 07.

16.2.1 Upper Level

The upper level of Railcar #16 shall be the same as Railcar #15, except as follows:

a) There shall be an upper level pass through with automatic doors at both end.

b) The direction of travel shall be in the opposite direction with respect to the A end, B ends of the Railcar

c) The banquette directly across from the stairway and the one immediately adjoining it shall both be convertible to wheel chair access. They shall be convertible by the removal of one of the two seats in each banquette and by raising the table 2" using the table lifting mechanism built in to the wall.

16.2.2 Lower Level

16.2.2.1 Office

The lower level shall contain an office designed to accommodate 8 PM staff persons. It shall include a connection to a cellular antenna installed on the top of the Railcar, an IEE 802.3-10 Base coaxial cable for an office computer network installed for 8 computer stations, 10 duplex outlets on 4 separate 20 amp 110 VAC circuits for office equipment, 8 modular phone plugs connected to 8 modular plugs in a water tight box on the Railcar's exterior side sill, carpet throughout, ceiling mounted florescent light fixtures containing SP 3500 bulbs, sufficient to produce 50 ft candles of light on all work surfaces, approximately 30" above the floor, a door hinged inwardly in a 32" wide door opening exiting into the hallway.

16.2.2.2 Kitchen Service Area

The kitchen service area shall contain the following features and equipment:

a) 2 dumb waiters as described in Railcar #15.

b) 25 lineal feet of stainless steel counter tops.

c) 25 lineal feet of stainless steel shelving.

d) 6, 24" by 36" stainless steel cabinet doors with latches.

e) 1 Utility 90-R-3S reach-in refrigerator (84 cu. ft.).

f) 1 vegetable sink integral to the stainless steel counter.

g) 1 hand sink integral to stainless steel counter.

h) 2 Hatco 48" food warmers.

i) 4 duplex 120 VAC convenience outlets on two separate 20 amp circuits.

j) 1 36" door opening with bi-parting, double swinging service doors.

k) 1 side access hatch for resupply, with a clear opening of 26" high by 30" wide

l) 1 separate HVAC system, including 2 1/2 tons of A/C, 1500 CFN exhaust fan and 1700 CFN make-up air unit with air filters.

m) Surface mounted florescent fixtures containing SP 3500 40 watt tubes with two blocks in damp service area rated fixtures with polycarbonate lenses. Sufficient to produce 50 ft. candles of light on all work surfaces, approximately 36" above the floor.

n) A floor pan the full width of the service kitchen, constructed of type 304 stainless steel, flanged and welded to produce a leak proof stainless steel pan, with fitted and sealed stainless steel cover for access to the center pin

o) Removable rubber non-slip matting to cover the service kitchen floor.

16.2.2.3 ADA Compliant Lavatory

This Railcar shall contain one ADA compliant lavatory, built in accordance with the Specifications obtained in Section 11 for an ADA lavatory.

16.2.2.4 ADA Compliant Hallway

The hallway around the office and service kitchen shall be ADA compliant and therefore not less than 32" clear and shall be finished as per the standard for Railcar hallways as defined in Section 11.

16.2.2.5 Door End Doors

Railcar #16 shall contain two automatic end doors with power operators. Doors and operators shall be built and installed as specified in Section 11 for standard end doors and door operators.

16.2.2.6 Public Address System

All areas of the lower level, including the ADA lavatory, office and service kitchen shall be equipped with speakers, from the public address system, and a three channel audio selector. In addition the railcar shall carry insolectric locker be required PA amplification system.

LOUNGE CARS (CARS #17,18 & 19)
SECTION 17

17.1 OBSERVATION LOUNGE/GENERAL STORE (RAILCAR #17)

Railcar #17 is an observation lounge Railcar with a lounge and general store on the lower level. It shall be constructed in accordance with Contract Drawing LTNG 08. It shall contain an ADA compliant lift to transport wheel chair bound passengers from the lower to the observation lounge level. The hallways and mobility spaces in the Railcar shall be not less than 32" in width and shall be designed to accommodate the passage of a standard wheelchair between Railcars 17 and the adjoining Railcars on either side at both the upper and lower level.

17.1.1 Seating

The upper level shall contain approximately 60 seats in living room like observation lounge configuration. The seats shall be a combination of small couches, individual seats and banquettes. The seating plan shall be as selected by PM. The total allowance for seating, including construction, fabrication, foam, fabrics and delivery shall be $400 per passenger seat, for a total allowance in the lounge area of $24,000, not to exceed $24,000. Seating shall meet the general strength, flammability and combustion products generated standards of the general seating Specifications in Section 11.

The downstairs lounge area shall contain approximately 30 seats in an informal living room type setting. The seating plan shall be as selected by PM. The allowance for seating shall not exceed $400 per seat, as described in the upper level seating above.

17.1.2 Lighting

The observation level lighting shall be dimmable fluorescent bulbs type SP3500, 40 watt, concealed behind aluminum paracube. The dome level lighting shall be dimmable from a single common switch located as selected by PM. Emergency lighting installed in accordance with Section 9 above, shall consist of Puk light, 12 volt quartz halogen incandescent fixtures installed behind the paracube in the ceiling. Downstairs lighting shall consist of indirect fluorescent lighting with dimmable ballast, which shall be installed in an indirect lighting fixture as selected by PM. Separate sections of the lower Railcar shall be provided with their own separate lighting circuits and controls. Control locations as to be selected by PM. Emergency lighting shall be provided as described above and in Section 9.

17.1.3 Heating Ventilation and Air Conditioning

The Railcar shall be equipped with four (4) self contained air conditioning and heating units whose nominal rating shall be not less than nine (9) tons of air conditioning and 14KW of resistance heat. The four (4) units shall be installed in accordance with the general provisions of Section 9.

Make-up air shall be provided by a controlled make-up air unit in each of the 4 main return air ducts. The make-up air shall be controllable from zero to 300 CFM per inlet.

Air conditioning and heating controls shall be zoned. The observation lounge shall be divided into two zones, the A end and B end. The lower level shall be divided into two zones as selected by PM.

17.1.4 Bar and Buffet

The observation level shall be equipped with one service bar, which shall measure approximately 78" wide by 38" front to back and shall be constructed in accordance with the Specification for service bars in Section 11. The location of the service bar shall be as selected by PM.

The observation level shall also contain a buffet cabinet, which shall be approximately 12' in length and 30" in depth and shall be installed in a location as selected by PM. This buffet line shall be designed to accommodate buffet meal service for breakfast and lunch and for a midnight buffet.

The lower level shall contain a standard service bar as described in Section 11 and which shall be located as selected by PM.

17.1.5 Toilets

The lower level shall contain one (1) ADA toilet as described in Section 11. It shall be located directly across the stairwell and ADA lift as described on Contract Drawing LTNG 08.

17.1.6 Wall Coverings

Wall coverings shall be as described in Section 11.

17.1.7 Carpet

The entire Railcar shall be carpeted in accordance with the Specifications for carpet in Section 11.

17.1.8 Doors

The Railcar shall have 4 in doors, 2 each at each level. These shall be automatic doors, constructed and installed in accordance with the standard door description in Section 11.

17.1.9 Blinds and Curtains

This Railcar shall not have blinds or curtains, other than decorative curtains as selected by PM. The allowance for decorative curtains shall not exceed $1500 for the Railcar.

17.1.10 Convenience Outlets

In addition to the fourplex convenience outlet, installed in each bar, there shall be 10 duplex convenience outlets installed in the upper level and 8 convenience outlets installed in the lower level at locations as selected by PM. These shall be wired to convenience outlet circuits in accordance with the National Electrical Code.

17.1.11 Television, VCR, Communications

The Railcar shall be equipped with twelve (12) speakers on the upper level and ten (10) speakers on the lower level, including one (1) in the ADA toilet. These speakers shall be connected to a Railcar amplifier, of sufficient output wattage to provide adequate sound levels. The Railcar amplifier shall be connected to the 3 channel audio system provided throughout the Trainset. The Railcar shall contain no television or VCR.

17.1.12 Heat Detectors

The Railcar shall be equipped with rate of rise heat detectors as specified in Section 9.

17.1.13 Emergency Exits

The Railcar shall be equipped with four (4) emergency exits at each level. Emergency exits shall be in compliance with the Specifications requirements.

17.1.14 Diaphragms

The Railcar shall be equipped with diaphragms at each end, for both upper and lower level walk through. Diaphragms shall be constructed and installed in accordance with Section 10.

17.2. OBSERVATION LOUNGE/MULTI-MEDIA/OPEN PLATFORM CAR (Railcar #18)

Railcar #18 shall be an observation lounge Railcar with approximately sixty (60) seats in a living room configuration on the lounge level with a service bar. The lower level shall contain a multi-media room and a section of Virtual Reality games, as well as, an open platform approximately 10' in length with boarding stairs and trap doors.

The specifications for Railcar #18 shall be in all respects similar to Railcar #17 except as follows.

17.2.1 ADA Lift

There shall be no ADA lift in Railcar #18.

17.2.2 Buffet Cabinet

There shall be no buffet cabinet in Railcar #18.

17.2.3 Service Bar

There shall be no service bar, on the lower level in Railcar #18.

17.2.4 Configuration

The lower lever of Railcar #18 shall contain 2 rooms and an open platform. The rooms and their specifications and contents are as follows:

17.2.4.1 Virtual Reality Game Room

PM shall provide virtual reality games to be placed in a Virtual Reality game room, whose final space requirements shall be as selected by PM. Said Virtual Reality games must be capable of being installed through a 32" wide door opening.

17.2.4.2 Multi-Media Room

A multi-media room shall be constructed on the lower level. It shall consist of approximately 10 row of 3 seats each, facing a large screen T.V. (50" diagonal measure). The seating shall be approximately 26" width, and be constructed in compliance with the general specification on seating in Section 11. The allowance for seating shall be $400 per person for a total of $12,000 for the 30 seats of the multi-media room, including design, construction, fabrics, foam and delivery. Contractor shall provide the 50" big screen television and VHS standard VCR.

The final layout for the multi-media room shall be as selected by PM and may ether be a sidewalk around or an aisle down the middle.

17.2.5 Open Platform

Railcar #18 shall have an open platform approximately 10' long. The open platform shall be finished in Imron 5000 polyurethane paint in a color as selected by PM. The open platform shall have side entry stairwells with trap doors for loading and unloading passengers. The platform shall contain handrails on 3 sides to a height not less than 48". The handrails shall be constructed in conformance with general the Specifications on handrails in Section 11 above. The end entry door shall be at the in board side of the platform. A bi-parting lockable gate shall be placed at the open platform end of the Railcar. Two outdoor speakers connected to the Railcar sound system shall be placed on the open platform. Open platform lighting shall be provided by 12 volt, quartz halogen Puk light fixtures with lens covers installed in the sheet metal ceiling of the platform.

17.3 LOUNGE/DISCO/SALOON (RAILCAR #19)

Railcar #19 shall be an observation type Railcar containing a dance floor and lounge seating on the upper level and a saloon with bar, card dealers, dance floor and pinball machines on the lower lever. Railcar #19 shall be constructed in accordance with Contract Drawing LTNG 10. The Railcar shall have ADA accessible aisle and facilities, reachable from the upper or lower levels of railcar #18, which adjoins this Railcar.

17.3.1 Seating

The observation level shall contain 2 lounge seating areas. The total seating available in these two seating areas shall be approximately thirty (30) seats. The seating shall be constructed in accordance with the seating requirements found in Section 11. The allowance for seating shall not exceed $400 per seat, including fabrics, fabrication, foam and delivery to Contractor.

Lower level seating shall be provided in two areas, bar stools at the bar and high chairs at the two (2) card dealer tables. The bar shall accommodate approximately twelve (12) stools. The stools shall be affixed to the floor and in all manner shall conform to the Specifications requirements for seating construction in Section 11. The card dealer tables shall accommodate approximately five (5) high chairs each. These chairs shall be affixed to the floor and be constructed in accordance with the seating construction requirements in Section 11.

The allowance for the above mentioned twenty-two (22) barstools and card chairs combined shall not exceed $250 per chair or stool, delivered to Contractor.

17.3.2 Lighting

Due to the theatrical nature of the Disco and Saloon, a special provision has been made for lighting in this Railcar. The Specifications provide for an allowance of 80 recessed quartz halogen fixtures for the Railcar, at an average cost of $80 each plus 4, 3 seen light- a-leer controllers, at an average cost of $650 each, plus installation of the forgoing. This will allow theatrical lighting with precision control and color rendering. There is no provision for general fluorescent lighting in this Railcar.

Emergency lighting shall be provided in accordance with the Specifications requirements on Emergency lighting in Section 11 including installation of 12 volt Puk light fixtures throughout the Railcar and including one in each toilet.

17.3.3. Heating Ventilation and Air Conditioning

HVAC shall be installed as described in Railcar #17 above.

17.3.4 Bar

The upper level shall have 1 bar as shown on Contract Drawing LTNG 10, which shall contain Corian or Plastic Lament counter top as selected by PM, two (2) 30" Delfield under counter refrigerators, large ice bin, two (2) compartment integral sink with TNS faucets, liquor storage area, mirrored back bar and non-slip rubber matting as installed in the kitchen. An allowance not to exceed $10,000 will be made for the construction of the upper level bar.

The lower level shall contain a saloon bar approximately 18' long with mirrored back bar, under counter refrigeration consisting of two (2), 30" Delfield refrigerator units, large ice bin, two (2) compartment integral sink with TNS faucets and counter service of Corian, Plastic Laminate, or wood or stone laminate as selected by PM and consistent with good cabinetry construction, practices and Railcar fire requirements. It is the intention of this bar to give the appearance of an old styled saloon bar with mirrored back bar for displaying liquor. An allowance not to exceed $25,000 has been made for the construction of the lower level saloon bar.

17.3.5 Toilets

The lower level shall contain two (2) toilets. One (1) ADA toilet and one standard unisex toilet, both constructed in compliance with Section 11.

17.3.6 Wall Coverings

The upper level and lower level wall coverings shall be as selected by PM and shall be constructed of Plastic Laminate, Wood

Veneer over fireproof substrate, or other materials not to exceed $10 per square foot of surface area including trim. It is understood that the use of solid wood trims to compliment the veneers will be possible in limited quantities due to the fact that solid wood trims contribute to total combustible materials in the Railcar. Solid wood trims will be treated with fire retardant materials before finishing.

17.3.7 Carpet, Floor Coverings, Dance Floors

As shown in Contract Drawing LTNG 10, dance floors are provided on both the upper and lower levels. It is assumed that the floor, to be selected by PM, will have a wood grain look and be installed in both the upper and lower Railcar floors. An allowance of $9600 installed has been made for an appropriate wood look floor, which shall be in compliance with the fire specifications of the Specifications. Provision has been made for a small raised stage portion, which shall get the same floor treatment.

17.3.8 Doors

There shall be upper and lower level automatic doors installed at the A end of Railcar #19 and adjoining Railcar #18. There shall be a single low level door installed at the B end of Railcar #19 and adjoining Railcar #20. There shall be no upper level pass through at the B end of Railcar #19. Doors shall be constructed and installed in accordance with the general Specifications on doors found in Section 11 herein.

17.3.9 Blinds and Curtains

There shall be no functional blinds and curtains installed in this Railcar. On allowance of $1500 for Railcar #19 has been provided for the installation of decorative curtains.

17.3.10 Convenience Outlets

There shall be two (2), fourplex convenience outlets installed in the upper level bar and two (2), fourplex convenience outlets installed in the lower level bar at locations to be selected by PM. In addition there shall be six (6), duplex outlets installed on each longitudinal wall at the upper and lower levels (total twenty-four (24) outlets) in accordance with NEC standards.

17.3.11 Television, VCR, Communications Speakers

There shall be twelve (12) speakers installed in the ceiling of the upper level and twelve (12) speakers to be installed in the ceiling of the lower level. They shall be connected to two (2) separate amplifiers, one for each level, which shall provide adequate amplification for the Railcars. The amplifier shall be connected to the 3 channel Trainline audio system. It is expressly understood that the Specifications do not include an allowance for a theater of performance type sound system, which sound system shall be provided by PM and installed by Contractor as Extra Work to be priced to be agreed upon in accordance with the provisions of the Agreement.

17.3.12 Heat Detectors

Railcar #19 shall be equipped with rate of rise heat detectors in accordance with the Specifications in Section 9 above.

17.3.13 Emergency Exits

This Railcar shall be equipped with four (4) emergency exits on each level, two (2) on each side of the Railcar as provided in the Specification for emergency exits in Section 10 above. The Railcar shall be equipped with one diaphragm on the A end for passage at both the upper and lower levels, and one diaphragm on the B end for passage at the lower level only.

17.3.14 Card Tables and Pinball Machines

Contractor shall provide two (2) blackjack tables. PM shall provide pinball machines, which shall be capable of passing through a 32" wide clear door opening and which shall utilize 120 volt convenience outlets.

SPA CAR (CARS #20)
SECTION 18

Railcar #20, the Spa Car, shall be built in accordance with Contract Drawing LTNG 11. It shall contain two (2) women's dressing rooms with sink and toilet, one (1) men's dressing room with sink and toilet, two (2) massage rooms, six (6) hot tubs and an open platform. It shall be a low level domed railcar with eighteen (18) domed widows and four (4) glass roof panels covering a 10' open platform.

18.1 LIGHTING

The massage rooms and dressing rooms shall be lighted with recessed incandescent bulb fixtures. There shall be three (3) such 100 watt fixtures in the men's dressing room, two (2) in each of the women's dressing rooms and two (2) in each of the massage rooms. A fixture allowance of $89 per fixture is included in the Specifications. Each lighting fixture shall be controlled by an appropriate wall switch in a location as selected by PM.

General lighting in the hot tub area shall be provided by recessed florescent fixtures containing electronic dimming ballasts, 40 watt florescent bulbs of the SP3500 type. These fixtures shall be concealed behind an aluminum paracube ceiling panel and shall be controlled by a single lutron dimmer, the location of which shall be as selected by PM.

The open platform shall be lighted by six (6), 20 watt 12 volt Puk light fixtures with covering lenses.

Emergency lighting shall be provided in each lavatory and massage room, as well as, behind the paracube in the hot tub area, all in compliance with the emergency lighting requirements of the Specifications, Section 9.

18.2 MASSAGE ROOMS

Railcar #20 shall contain two (2) massage rooms, which are approximately 6' 3" by 6' 6" in inside dimension. Each massage room shall contain one (1) massage table approximately 6' 6" long and supplied by Contractor, in addition each room shall contain towel storage racks sufficient to store twenty (20) towels. The rooms shall be finished in a wall covering to be as selected by PM. The allowance for wall coverings is covered in Section 11, under Interior Standards for Walls.

Each massage room shall contain two (2) GFI protected duplex 120 volt wall outlets.

18.3 WOMEN'S DRESSING ROOMS

This Railcar shall contain two (2) women's dressing rooms, which shall be constructed as shown in Contract Drawing LTNG 11 and which shall contain the same features and equipment. Each room shall contain one (1) toilet one (1) 10" round sink with hot and cold water, self closing faucets (Chicago #40BA665) in a Corian counter top. The room shall also contain one (1) sitting bench, which shall be wall mounted and shall be approximately 30" long by 12" wide. Mounted on the exterior wall of the dressing rooms shall be not less than six (6) hooks for hanging clothing while changing. Each dressing room shall contain a hinged door and latching hardware with indicators on the exterior showing, occupied or open. The door opening shall be not less than 19" wide. Each women's dressing room shall contain one (1) GFI protected duplex 120 volt AC convenience outlet. The flooring shall be Loncoin Sheet Vinyl or equivalent adhered according to manufactures instructions and finished with a minimum 4" high cove base. Each dressing room shall be equipped with a floor drain for cleaning. The floor drain shall be sealed while the Railcar in under way. Wall coverings shall be vinyl, plastic laminate, or other surface as specified in compliance with Section 11, Standard Interior Walls.

18.4 MEN'S DRESSING ROOM

There shall be one (1) men's dressing room, approximately 10' long by 38" wide. It shall contain separate dressing and toilet areas. The toilet area shall contain one (1) toilet and one (1) sink as specified for the women's dressing room above. A door shall separate the dressing area from the toilet area. The dressing area shall contain a bench approximately 7' long by 1' wide. On the exterior wall above the bench, there shall be not less than eight (8) hooks for hanging clothing while changing.

The men's dressing room shall contain a single inwardly hinged door. The door shall contain locking hardware, which shall indicate, in use or open. Some of the hardware shall be applied to the door the between the men's dressing area and the toilet.

Men's dressing room flooring shall be Loncoin or similar. Men's dressing room shall contain one (1) 120 volt duplex convenience outlet, mounted on the exterior wall.

Interior wall finish shall be vinyl, plastic laminate or other interior wall surface as specified in Section 11.

18.5 HOT TUBS

The Spa Car shall contain six (6) hot tubs whose overall dimensions are 6' wide by 6'long by 2' high. Each hot tub shall be self contained and shall include 208 volt heater, circulating pump, chlorinator and an automatic fill valve. The automatic fill valve, on each hot tub, shall be connected to a common hot water line from the Railcar hot water heater, which shall provide 120°F hot water to the hot tub on demand of the automatic fill valve. Each hot tub shall be equipped with a safety hand railing for use in entering and exiting the hot tub.

The hot tub shall be constructed of fiber glass reinforced plastic in accordance with the Specification for fire retardant materials contained herein.

In addition to the automatic fill valve, each hot tub shall be equipped with a manual drain and a manual fill valve, to enable rapid emptying of the tubs and refilling. Color, jets, and style shall be as selected by PM. The hot tubs shall be enclosed in one (1) common base surrounding three (3) hot tubs.

Each hot tub shall be equipped with not less than four (4) water jets, strained return water vent and overflow type strainer. Each hot tubs filter shall be changeable ether by the top or the front of the tub.

The self contained hot tub heater shall be of sufficient size to maintain 105°F hot tub temperature with a room temperature of 80°F during normal usage and with water and air jets operational.

18.6 DOORS

Massage rooms shall be equipped with hinged inward opening doors with indicating latching hardware. Dressing rooms shall be equipped with hinged inward opening doors with indicating latching hardware.

The dressing room into the Railcar shall be equipped with one (1) automatic door, constructed and installed in accordance with the standard door Specification in Section 11. The open platform end of the hot tub room shall be equipped with a single automatic opening door, constructed and installed in compliance with Specification for doors in Section 11 above, except that it shall have the largest possible glass opening in the upper portion of the door. The glass inset of proportion of the door shall be FRA type one compliant.

18.7 FLOORING

The flooring in the dressing rooms and massage rooms shall be Loncoin, color to be selected by PM. The flooring in the hall and hot tub area shall be a self draining rubber type of non-slip mat. Underlying the hot tubs and hallways shall be a welded, sealed seam stainless steel pan (type 304) with an adequate number of floor drains to assure good drainage of overspill from the hot tubs. The stainless steel floor pan shall be coved up the side wall a minimum of 4". The side wall of the Railcar, under the dome windows, shall be type 304 stainless steel sheet, which sheeting shall overlap the 4" floor pan flange and be sealed with a kitchen grade aluminum color stainless steel cox and sealant. The open platform floor shall be Loncoin , color to be selected by PM. The open platform shall be covered with a stainless steel pan, similar in construction to that described above for the hot tub portion of the Railcar. The open platform shall be provided with two floor drains which shall be capable of being sealed when the Railcar is under way.

18.8 HEATING VENTILATION AND AIR CONDITIONING

Due to the unique load imposed by the hot tubs, this Railcar shall be equipped with heating and ventilation systems which are not identical to nor exchangeable with those of the other Railcars. The Railcar shall be provided with a 2500 per minute cubic foot exhaust fan which shall be kept variable in three (3) speeds producing exhaust volumes of approximately 1000 cubic feet per minute, 1750 cubic feet per minute and 2500 cubic feet per minute. The fan speed shall be controlled by a variable frequency solid state device, connected to a 240 volt three (3) phase exhaust fan. The exhaust fan unit shall be ceiling mounted in the space above the massage rooms.

The heating and air conditioning shall be provided by four (4) self contained units nominally rated at 24 tons. The design of these units shall be consistent with the other under Railcar units but these units shall not be exchangeable with them. The heating capacity of the Railcar shall be 56KW (14KW in each of four (4) units). A make-up air unit consisting of a dampered exterior intake, air filters, and intake fan shall be installed in the Railcar and shall feed make-up air into each of the return air ducts. The capacity intake unit shall be 2500 CFM and it shall be step selectable in steps of 1000 CFM, 1750 CFM and 2500 CFM. Due to extreme humidity conditions and the concomitant requirement for extremely high quantities of exhausted make-up air, the manufacture does not warranty the ability of the air conditioning to retain the Railcar temperature within the standards specified for the balance of the Trainset.

18.9 CONVENIENCE OUTLETS

In addition to the convenience outlets all ready specified in the massage rooms and dressing rooms, there shall be three (3) duplex convenience outlets, GFI protected, installed in the sidewalls of the hot tub room at locations to be selected by PM.

18.10 COMMUNICATIONS SYSTEM/ SPEAKERS

Two (2) exterior type speakers shall be installed on the open platform, eight (8) in the hot tub area, and one (1) each in the massage rooms and dressing rooms. These speakers shall be connected to the Railcar amplifier, which shall be of sufficient output to provide for good quality and sound level. In addition the amplifier shall be connected to Trainline communication system and shall include a three (3) position selector switch for selecting one of the three audio channels of the train system.

18.11 HEAT DETECTORS

Railcar #20 shall be equipped with rate of rise heat detectors and annunciator panel consistent with the requirements of Section 9.

18.12 EMERGENCY EXITS

Railcar #20 shall include four (4) emergency exits two (2) on each side of the Railcar.

18.13 DIAPHRAGMS

Railcar #20 shall have one (1) diaphragm installed on the dressing room end of the Railcar, which shall be compatible with the diaphragm installed on the trailing end of Railcar #19 and which shall be generally compatible with Amtrak Heritage Fleet Cars.

There shall be no diaphragm installed on the open platform end of the Railcar.

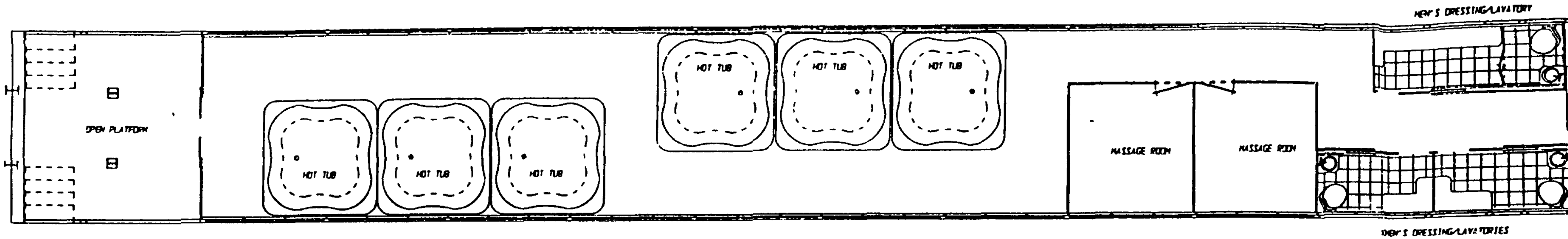
18.14 OPEN PLATFORM

The open platform of Railcar #20 shall be constructed in compliance with the Specifications set forth for Railcar #18 above.

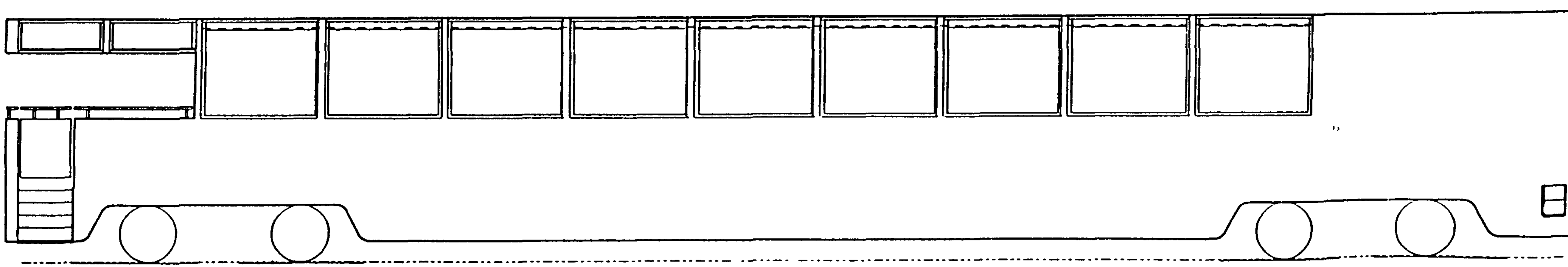
SCHEDULE B

CONTRACT DRAWINGS

This schedule consists of the 11 pages attached hereto.

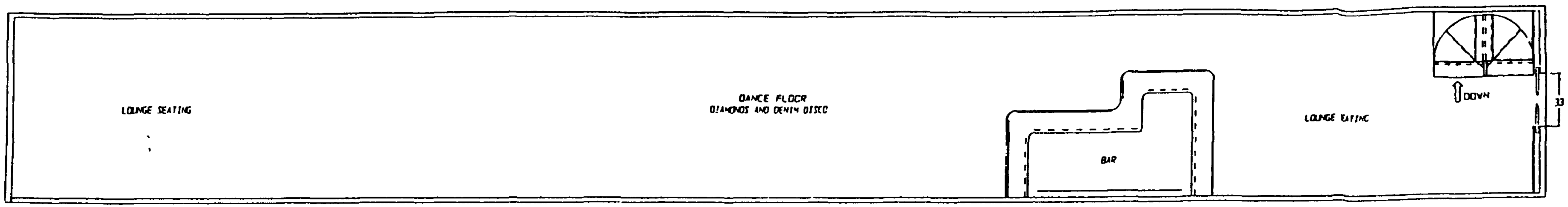


PLAN

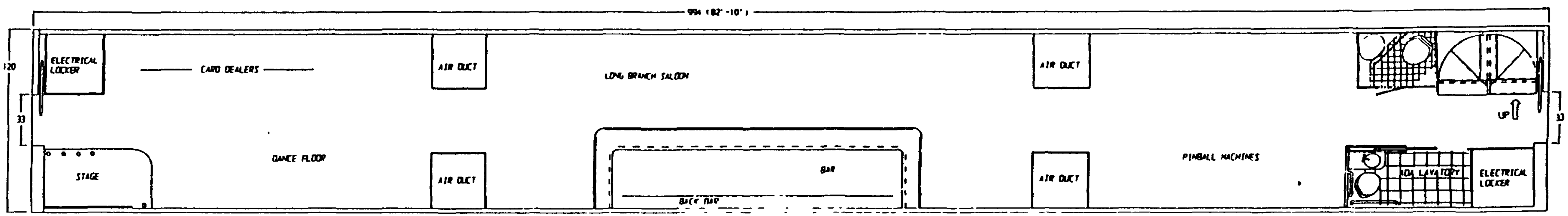


ELEVATION

RADER RAILCAR INC. DENVER, COLORADO ph (303) 371 4955	PROJECT LIGHTNING
	GENERAL ARRANGEMENT FOR LOW LEVEL DOMED SPA CAR RAILCAR #20
DRAWN BY: jss	DATE: 13sep94 / DRAWING NUMBER: LTNG11 / REV:
APPROVED BY:	SCALE: 3/8"=1'-0" / FILE #: LTNG11



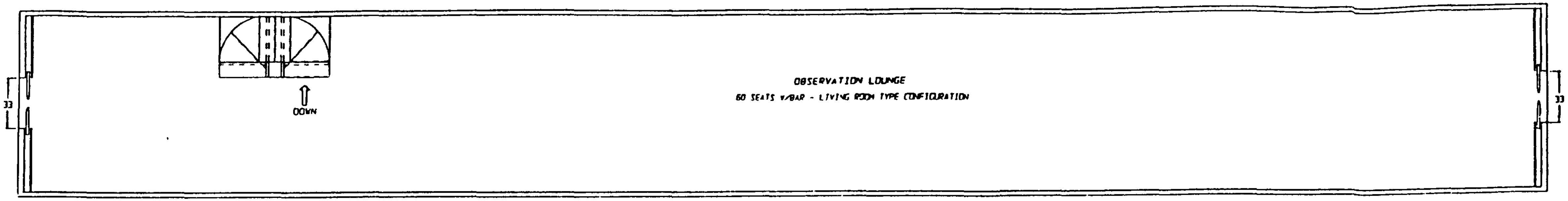
UPPER LEVEL FLOOR PLAN



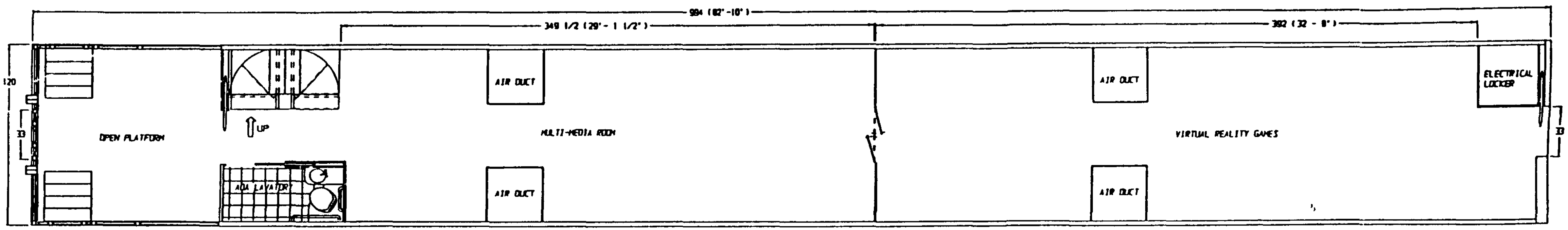
LOWER LEVEL FLOOR PLAN

DIRECTION OF TRAVEL ⟶

RADER RAILCAR INC. DENVER, COLORADO ph (303) 371-4955	CLIENT: PROJECT LIGHTNING
	GENERAL ARRANGEMENT DOME LOUNGE RAILCAR #19
DRAWN BY: JYY	DATE: 21sep94 · DRAWING NUMBER: LTNG10 · REV
APPROVED BY:	SCALE: 3/8" = 1'-0" · FILE #: LTNG10



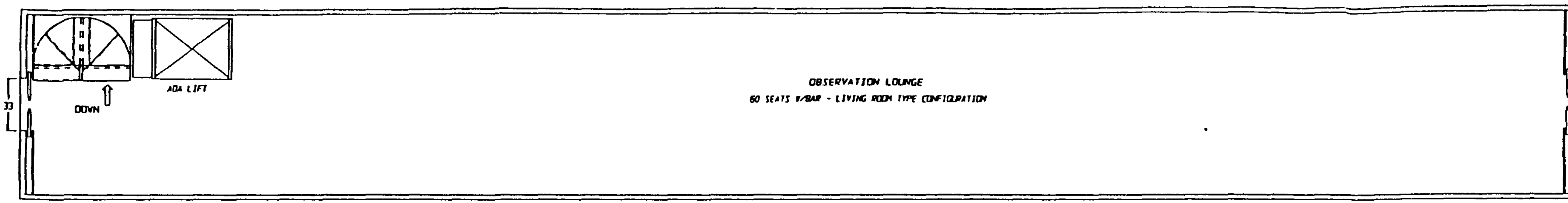
UPPER LEVEL FLOOR PLAN



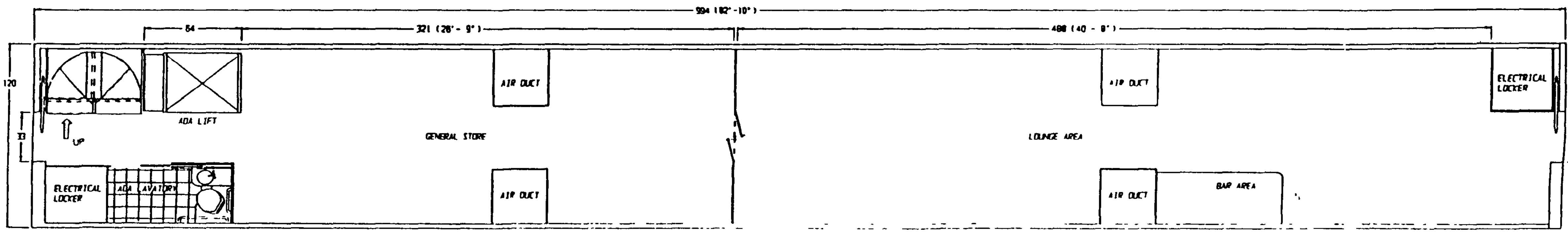
LOWER LEVEL FLOOR PLAN

DIRECTION OF TRAVEL ⟶

RADER RAILCAR INC. DENVER, COLORADO ph (303) 371-4955	CLIENT: PROJECT LIGHTNING		
	GENERAL ARRANGEMENT DOME LOUNGE RAILCAR #18		
DRAWN BY Jss	DATE: 13sep94	DRAWING NUMBER LTNG09	REV
APPROVED BY	SCALE: 3/8" = 1'-0"	FILE # LTNG09	



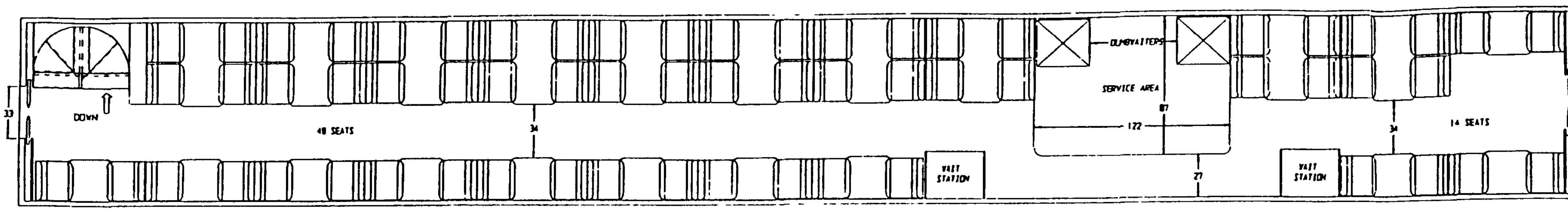
UPPER LEVEL FLOOR PLAN



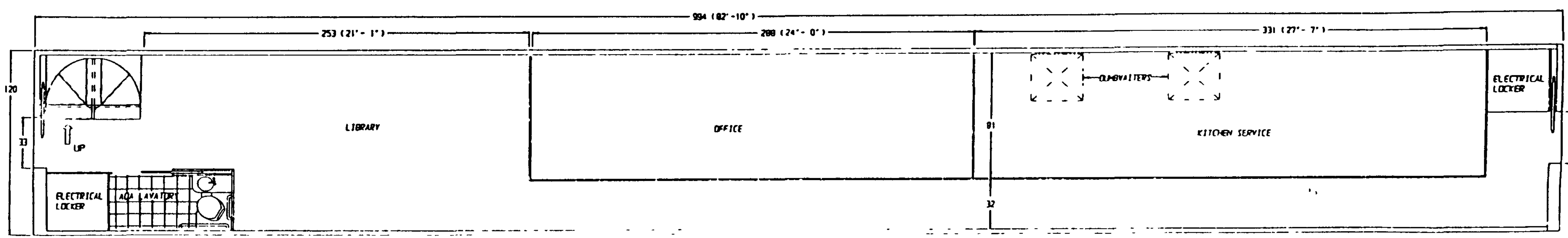
LOWER LEVEL FLOOR PLAN

DIRECTION OF TRAVEL ⟶

RADER RAILCAR INC. DENVER, COLORADO ph (303) 371-4955	CLIENT: PROJECT LIGHTNING		
	GENERAL ARRANGEMENT DOME LOUNGE RAILCAR #17		
DRAWN BY: Jss	DATE: 13sep94	DRAWING NUMBER: LTNG08	REV
APPROVED BY	SCALE: 3/8" = 1'-0"	FILE #: LTNG08	



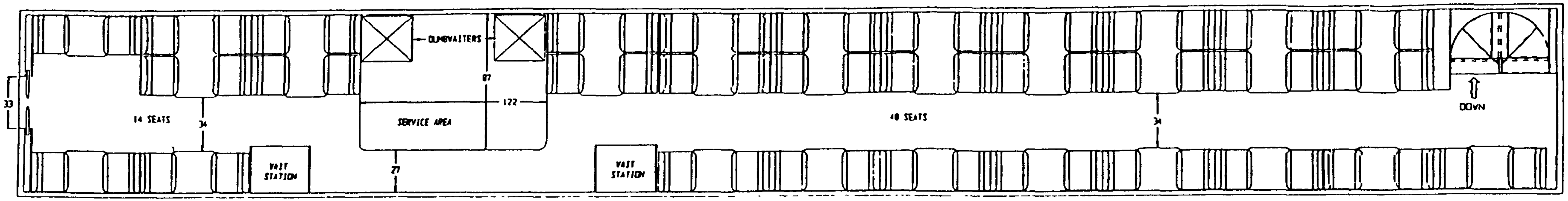
UPPER LEVEL FLOOR PLAN
62 SEATS



LOWER LEVEL FLOOR PLAN

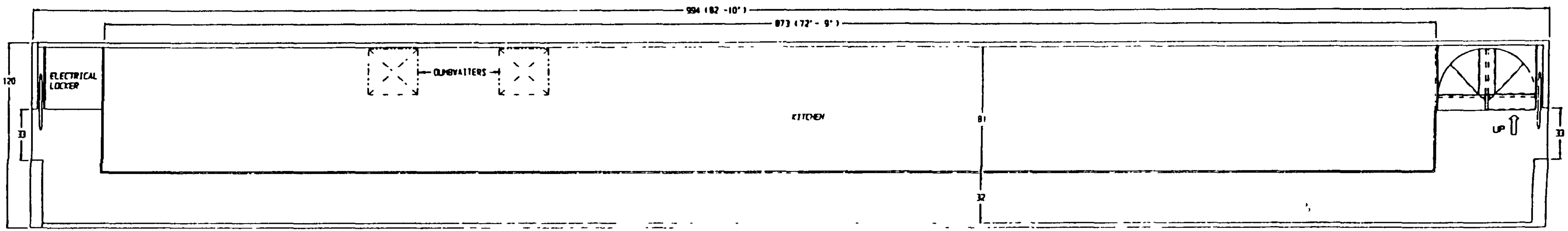
DIRECTION OF TRAVEL →

RADER RAILCAR INC. DENVER, COLORADO ph (303) 371-4955	CLIENT: PROJECT LIGHTNING GENERAL ARRANGEMENT DOME DINER RAILCAR #16
DRAWN BY JSS	DATE 13sep94 — DRAWING NUMBER LTNG07 — REV
APPROVED BY	SCALE 3/8" = 1'-0" — FILE # LTNG07



UPPER LEVEL FLOOR PLAN

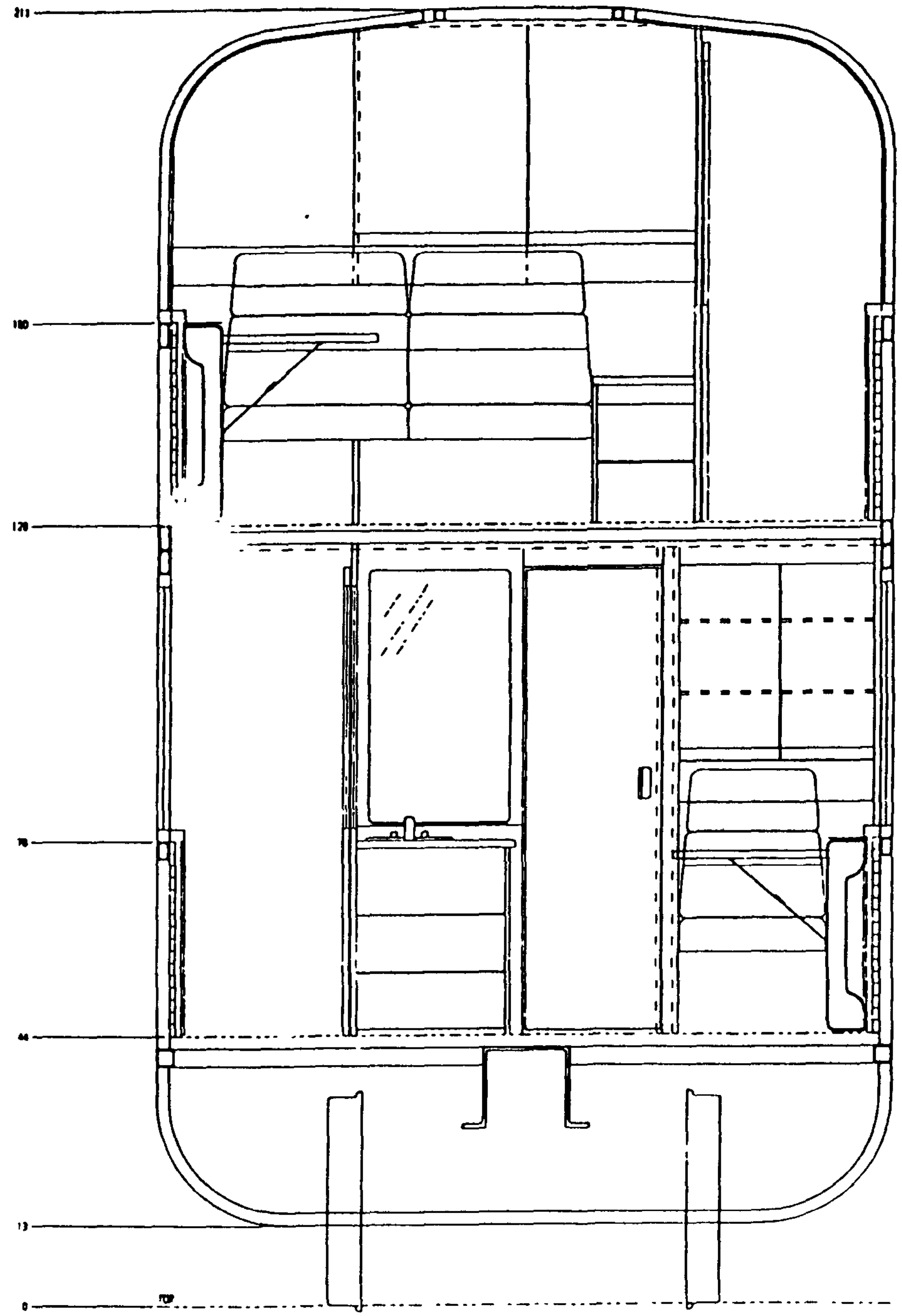
62 SEATS



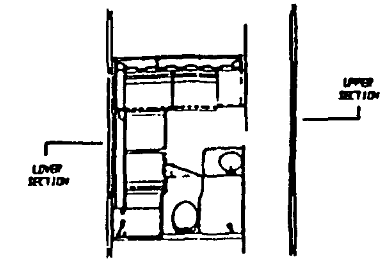
LOWER LEVEL FLOOR PLAN

DIRECTION OF TRAVEL →

RADER RAILCAR INC. DENVER, COLORADO ph (303) 371-4955	CLIENT PROJECT LIGHTNING			
	GENERAL ARRANGEMENT DOME DINER RAILCAR #15			
DRAWN BY JSS	DATE 13sep94	DRAWING NUMBER LTNG06		REV
APPROVED BY	SCALE: 3/8" = 1'-0"	FILE # LTNG06		

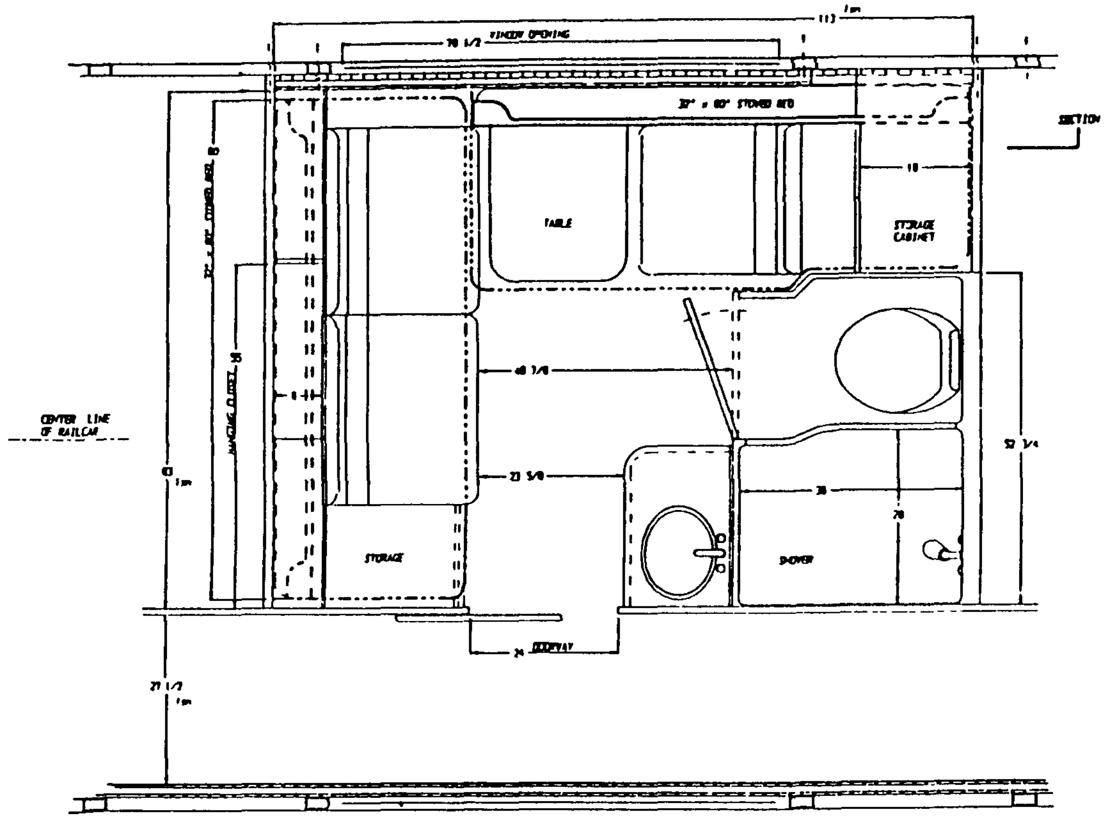


SECTION

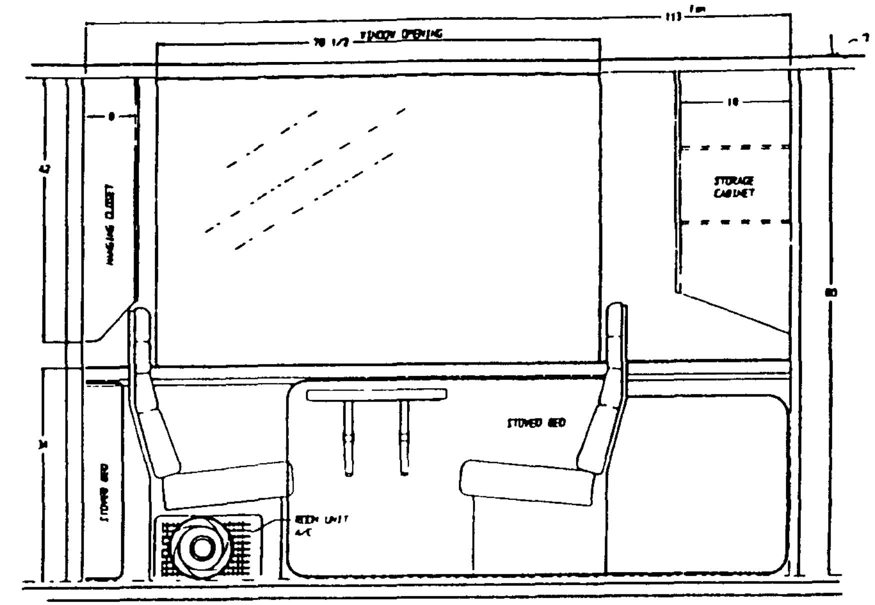


PLAN
NTS

RADER RAILCAR INC. DENVER, COLORADO ph (303) 371-4955	CLIENT: PROJECT LIGHTNING TYPICAL SECTION - DOMED SLEEPER RAILCAR
DRAWN BY JSS	DATE: 12sep94 DRAWING NUMBER LTNG05 REV



PLAN



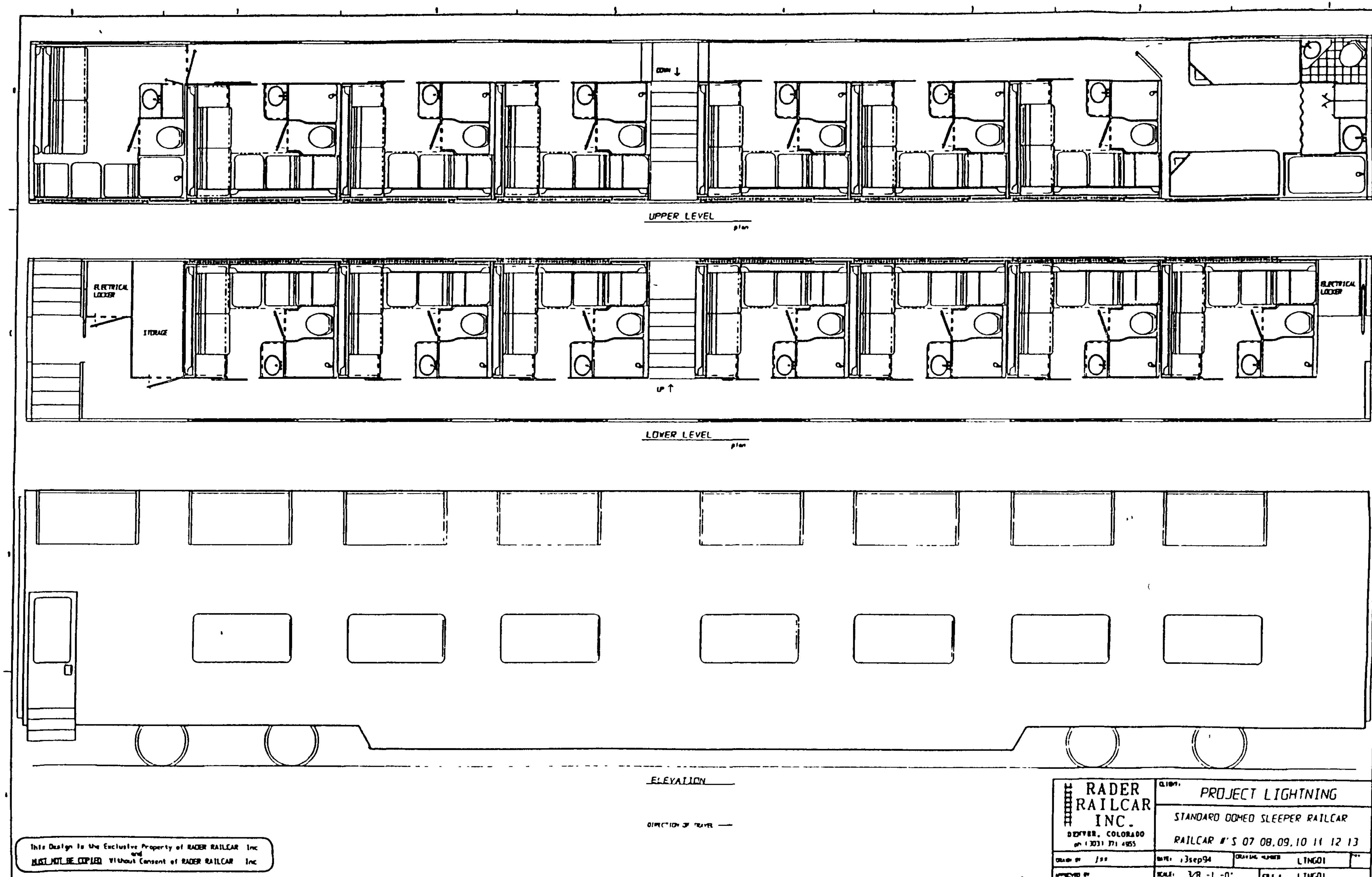
SECTION

RADER RAILCAR INC.
DENVER, COLORADO
ph (303) 371-4955

CLIENT: PROJECT LIGHTNING

GENERAL ARRANGEMENT FOR STANDARD STATEROOM

DRAWN BY JSS	DATE 12sep94	DRAWING NUMBER LTNG02	REV
APPROVED BY	SCALE 1"=1'-0"		



UPPER LEVEL
plan
ELECTRICAL LOCKER
STORAGE
ELECTRICAL LOCKER
LOWER LEVEL
plan
ELEVATION
DIRECTION OF TRAVEL
This Design Is the Exclusive Property of RADER RAILCAR Inc and MUST NOT BE COPIED Without Consent of RADER RAILCAR Inc
RADER RAILCAR INC.
DENVER, COLORADO
PROJECT LIGHTNING
STANDARD DOMED SLEEPER RAILCAR
RAILCAR #'S 07 08.09.10 11 12 13
DATE: 13sep94
DRAWING NUMBER LTNG01
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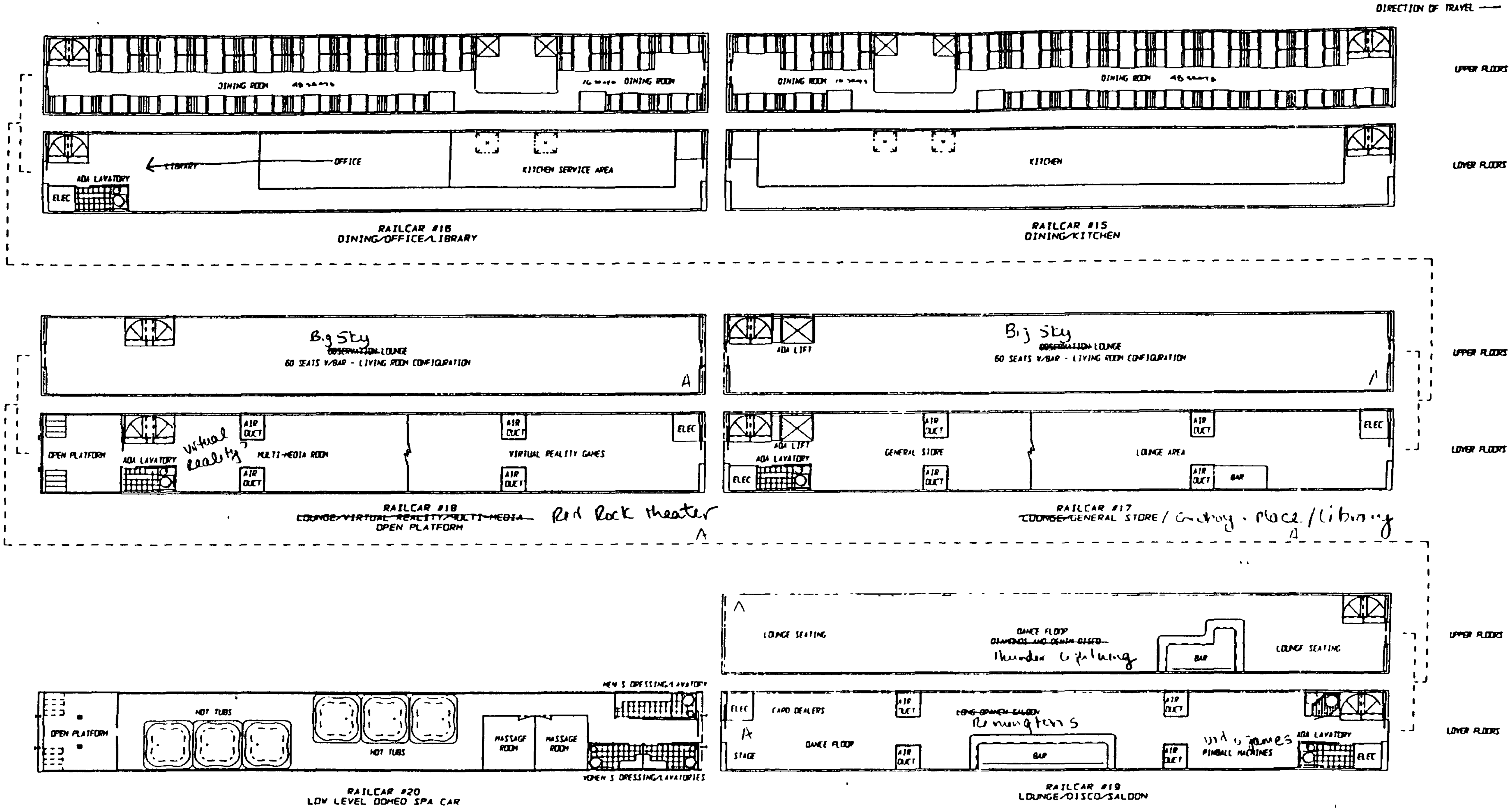
FILE # LTNG01

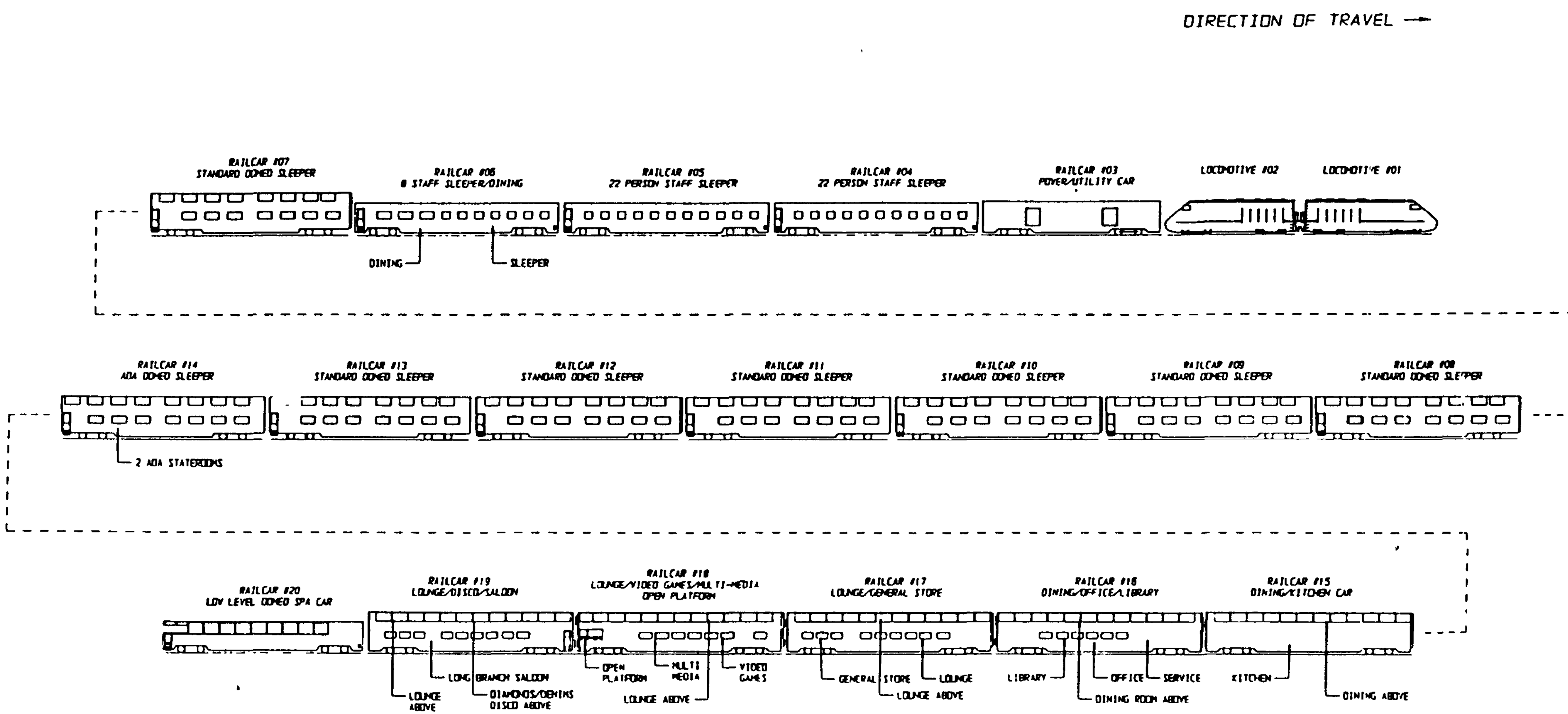


RADER RAILCAR INC.
DENVER, COLORADO
ph (303) 371 4955

PROJECT LIGHTNING

SCHEMATIC RAILCARS #15-20

DRAWN BY jss	DATE: 13sep94	DRAWING NUMBER	LTNG12
APPROVED BY	SCALE NONE	FILE #	LTNG12



RADER RAILCAR INC.
DENVER, COLORADO
ph (303) 371-4955

CLIENT: PROJECT LIGHTNING

SCHEMATIC TRAIN CONSIST

DRAWN BY	DATE	DRAWING NUMBER	REV
JSS	13sep94	LTNG00	

SCHEDULE C

CASH FLOW PROJECTIONS

This schedule consists of the 16 pages attached hereto.

PROJECT LIGHTNING
CASH FLOW

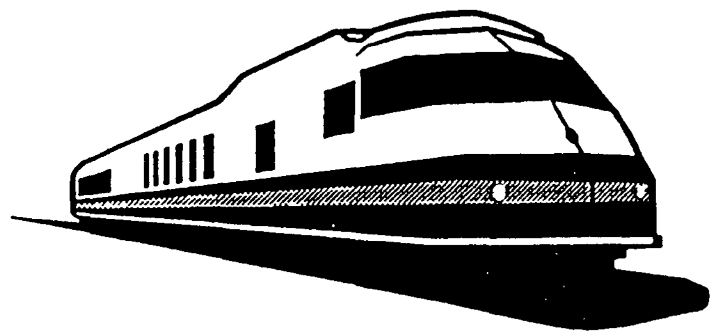


TABLE OF CONTENTS
CASH FLOW

RADER RAILCAR
PROJECT THUNDER
PRODUCTION CASH FLOW

JOB COSTS	REFERENCE	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
	MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
MANUFACTURING																				
Manufacturing and engineering	Manufacturing	$15 418	$190 080	$216 174	$191 924	$190 924	$166 924	$166 924	$125 540	$125 540	$125 540	$125 540	$125 540	$125 540	$125 540	$125 540	$125 540	$125 540	$125 540	$2 519 400
MATERIALS																				
On-car material	Material On-Car	2 750	58 750	322 150	516 275	367 650	537 150	562 150	449 400	548 900	449 000	48 000	0	0	0	0	0	0	0	3 862 175
Subassembly material	Sub-material	0	213 950	390 320	1 016 770	580 600	1 264 470	619 400	754 950	8 250	80 000	0	16 000	0	0	0	0	0	0	4 954 710
Subcontracting	Subcontracting	0	0	0	52 500	106 500	81 500	132,500	524 000	77 500	67 000	64 000	64 000	13 000	17 000	0	1 000	4 000	0	1 184 500
Purchased cars by Rader Railcar	Railcar purchases	0		0	0	675 000	0	0	0	0	0	0	0	0	0	0	0	0	0	675 000
Purchased cars from RRC	Railcar purchases	0	570 000	0	755 000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 325 000
TOTAL MATERIALS		2,750	842,700	712,470	2 342 545	1 729 750	1 863 120	1 334 050	1 728 350	632,650	596 000	112,000	80 000	13,000	17 000	0	1 000	4 000	0	12,021 385
DIRECT LABOR & BURDEN																				
Car plant labor	Car plant wages	10 800	74 660	110 320	166 020	274 020	324 220	399 620	431 120	415 000	392,700	377 420	363 260	372,840	353 080	232,120	160 320	87 660	3 400	4 548 660
Subassembly labor	Sub-labor	0	0	17 000	41 200	131 624	136 424	137 424	137 424	137 424	28 600	14 200	9 400	0	0	0	0	0	0	790 718
TOTAL DIRECT LABOR & BURDEN		10 800	74 660	127 320	207 220	405 644	460 644	537 044	568 544	552,424	421 300	391 620	372,660	372,840	353 080	232,120	160 320	87 660	3 400	5 339 378
OTHER JOB COSTS																				
Subassembly facility costs	Sub-Facility costs	0	81 815	78 631	89 556	93 056	92 308	90 808	88 808	87 608	86 108	72,988	62 463	62,013	51 321	51 071	51 421	35 195	11 195	1 185 950
Subassembly equipment	Sub Equip/leasehd	0	0	20 000	263 000	5 000	5 000	5 000	3 000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	0	0	317 000
Subassembly leasehold imp	Sub Equip/leasehd	0	85 000	80 000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	165 000
Car plant facility costs	Car plant facility costs	24 345	31 905	40 590	43 245	43 065	42,300	41 970	41 880	40 260	40 170	39 810	40 710	41 160	43 860	44 760	44 805	43 725	43 005	731 565
Car plant equipment/leaseholds	Equip/Lhds-Car Plant	0	153 250	270 250	71 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	24 000	23 000	22,000	838 500
Construction period insurance	2% cumulative WIP	224	3 309	6 572	13 159	18 320	23 836	28 402	33,725	36 818	39 572	41 271	42,652	44 300	45 703	46 831	47,825	48 639	49 218	570 576
TOTAL OTHER JOB COSTS		24 569	355 279	496 043	479 962	184 443	168 444	190 980	192,214	191 686	192,850	181 048	173 025	174 473	167 884	169 662	170 051	150 559	125 418	3 808 590
TOTAL JOB COSTS		53 536	1 462 719	1 554 007	3 221 651	2 510 781	2 698 131	2 227 907	2,614 658	1 502 300	1 335 690	810 218	751 234	686 862	663 513	527 331	456 920	367 787	254 427	23 688 755
ADMINISTRATION	Administration	58 560	83 291	84 191	84 666	88 016	83 516	83 516	80 816	80 816	80 616	80 616	81 716	82,616	83,516	83,516	88,016	88 016	84 416	1 481 036
TOTAL COSTS AND OVERHEADS		112,096	1 546 010	1 638 198	3 306 517	2,598 777	2,781 647	2,311 514	2,695 472	1 583 125	1 416 515	891 033	832,950	768 478	747 029	610 847	544 936	455 804	338 843	25 169 792
CONTRACT RETENTION		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,710 208	2,710 208
TOTAL THUNDER PAYMENTS TO RRC		$112,096	$1 546 010	$1 638 198	$3 306 517	$2 598 777	$2 781 647	$2 311 514	$2,695 472	$1 583 125	$1 416 515	$891 033	$832,950	$768 478	$747 029	$810 847	$544 936	$455 804	$3 049 051	$27 880 000

SUMMARY CASH FLOW

		OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
	MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
PROJECT THUNDER																				
MANUFACTURING																				
VP Manufacturing			9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	155 833
General Superintendent			7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	7 500	127 500
QA Manager			4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	77 917
QA Asst Manager			3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3,750	63 750
Car plant manager - 1st shift			6 250	6 250	6 250	6 250	6 250	6 250	6 250	6 250	6 250	6 250	6 250	6 250	6 250	6 250	6 250	6 250	6 250	106 250
Car plant manager - 2nd shift			4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	77 917
Production Control Manager			4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	4 583	77 917
Production Control Asst.			3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3,333	56 667
Engineering																				
VP Engineering			9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	9 167	155 833
Structural engineer		5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	97 500
Mechanical engineer			5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	92,083
Electrical engineer			5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	92,083
Contract engineers			35 000	35 000	35 000	35 000	35 000	35 000												210 000
Design/Drafting																				
VP Design		5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	5 417	97 500
CAD Drafters (4)			10 400	10 400	10 400	10 400	10 400	10 400	10 400	10 400	10 400	10 400	10 400	10 400	10 400	10 400	10 400	10 400	10 400	176 800
Contract drafting			3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	51 000
Job Administration																				
Accounting manager				1 875	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	58 125
Job costing / Billing				1 458	2 917	2,917	2 917	2 917	2 917	2 917	2 917	2 917	2 917	2 917	2 917	2 917	2,917	2,917	2 917	45 208
Accounts Payable (2)			2 083	4 167	4 167	4 167	4 167	4 167	4 167	4 167	4 167	4 167	4 167	4 167	4 167	4 167	4 167	4 167	4 167	68 750
Purchasing manager		2,427	2,427	2 427	2 427	2,427	2 427	2 427	2,427	2 427	2 427	2 427	2 427	2,427	2 427	2,427	2,427	2,427	2 427	43 690
Purchasing secretary			1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	29 467
Personnel manager			3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3 333	3,333	3 333	3 333	56 667
Personnel secretary			1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	1 733	29 467
Burden		3 315	33 573	34 928	35 761	35 761	35 761	35 761	27 011	27 011	27 011	27 011	27 011	27 011	27 011	27 011	27 011	27 011	27 011	511 978
Thunder Allocation Credit		(1 658)	(16 787)	(17 464)	(17 880)	(17 880)	(17 880)	(17 880)	(13 505)	(13 505)	(13 505)	(13 505)	(13,505)	(13,505)	(13 505)	(13 505)	(13 505)	(13,505)	(13,505)	(256 869)
TOTAL MANUFACTURING SALARIES		14 918	151 080	157 174	160 924	160 924	160 924	160 924	121 540	121 540	121 540	121 540	121 540	121 540	121 540	121 540	121 540	121 540	121 540	2,303 903
OTHER EXPENSES																				
Engineering/drafting supplies		500	3 000	4 000	4 000	3 000	3 000	3 000	2 000	2 000	2,000	2,000	2 000	2,000	2,000	2,000	2,000	2,000	2,000	42 500
Relocation			10 000	30 000																40 000
Test Center				25 000		25 000														50 000
Finate element analysis			25 000		25 000															50 000
Computer expense			1 000	2 000	2 000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	33,000
TOTAL MANUFACTURING EXPENSES		15,418	190 080	218 174	191 924	190 924	185 924	185 924	125 540	125 540	125 540	125 540	125 540	125 540	125 540	125 540	125 540	125 540	125 540	2,510 403

MANUAFACTURING

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18	TOTAL
RADER RAILCAR MATERIAL ON CAR PROJECT THUNDER																			
SHELL (Existing Car)																			
Welding/cutting supplies	1 000	1 000	1 000	1 000	1 000	1 000	1 000												7 000
Scrap and waste removal	500	500	500	500	500	500	500												3 500
Car move expenses	750	750	750	750	750	750	750												5 250
Steel for plates and car jacks	500	500	500	500	500	500	500												3 500
TOTAL SHELL ON-CAR MATERIAL	2,750	2,750	2,750	2,750	2 750	2,750	2,750	0	0	0	0	0	0	0	0	0	0	0	19 250
FRAME (Tube steel wall & stairs construction)																			
Welding/cutting supplies	0	4 000	4 000	4 000	4 000	4 000	4 000	4 000											28 000
Steel for access door frames		1 000	1 000	1 000	1 000	1 000	1 000	1 000											7 000
Angle iron for side sill		800	800	800	800	800	800	800											5 600
Weldthrough primer		200	200	200	200	200	200	200											1 400
TOTAL FRAME ON-CAR MATERIAL	0	6 000	6 000	6 000	6 000	6 000	6 000	6 000	0	0	0	0	0	0	0	0	0	0	42,000
FRAME (Dome/End of car skin construction/installation)																			
Welding/cutting supplies			4000	4000	4000	4000	4000	4000	4000										28 000
Steel for end of car door frames			1000	1000	1000	1000	1000	1000	1000										7 000
Weldthrough primer			400	400	400	400	400	400	400										2 800
TOTAL FRAME DOME ON-CAR MATERIAL	0	0	5 400	5 400	5 400	5 400	5 400	5 400	5 400	0	0	0	0	0	0	0	0	0	37 800
WALLS (Interior skins/walls insulation)																			
Wall Z channel				4 000	2 000	2,000	2,000	0	0	4 000									14 000
Inside walls				24000	12000	12000	12000	0	0	24000									84 000
Bathroom walls				4 000	4 000	4 000	0	0	0	0									12,000
Dining/lounge room walls				4 000	4 000	2 000	0	0	0	0									10 000
Kitchen SS walls				10 000	10 000	10 000	0	0	0	0									30 000
Other wall supplies				4 000	2,000	2,000	2,000	0	0	4 000									14 000
TOTAL WALLS ON-CAR MATERIAL	0	0	0	50 000	34 000	32 000	16 000	0	0	32,000	0	0	0	0	0	0	0	0	164 000
FLOORS (Ply-metal)																			
Floor installation supplies	0	0	0	3 000	3 000	3 000	3 000	3 000	3 000	3 000	2,000								23 000
TOTAL FLOORS ON-CAR MATERIAL	0	0	0	3 000	3 000	3 000	3 000	3 000	3 000	3 000	2,000	0	0	0	0	0	0	0	23 000
PAINTING (Ends and top)																			
Paint				39 000				3 000											42 000
Locomotive modifications				50 000			250 000												300 000
Consumables				20 000	2,000	2,000	2,000	2,000											28 000
TOTAL PAINT ON-CAR MATERIAL	0	0	0	109 000	2 000	2 000	252 000	5 000	0	0	0	0	0	0	0	0	0	0	370 000
UTILITIES-ELECTRICAL																			
HEP			43 500	29 000	29 000	29 000	29 000	29 000											188 500
27 Pin			15 000	10 000	10 000	10 000	10 000	10 000											65 000
Conduit and fittings			9 000	6 000	6 000	6 000	6 000	6 000											39 000
Lighting - Diners/lounges			24 000	24 000	12 000														60 000
Lighting - sleeper hallways			6 000	4 000	4 000	2,000													16 000
Lighting - emergency			3 000	2 000	2 000	2,000	2,000	2,000											13 000
Connectors			15 000	10 000	10 000	10 000	10 000	10 000											65 000
Speakers			6 000	4 000	4 000	4 000	4 000	4 000											26 000
Wire & labels - Diners/lounges			11 000	11 000	5 500														27 500
Wire & labels - Sleepers			33 000	22 000	22 000	11 000													88 000
Alarm systems			8 500	17 000	17 000	17 000	17 000	17 000	17 000										110 500
Sound/Video			2 000	4 000	4 000	4 000	4 000	4 000	4 000										26 000
Power car			80 000	80 000	50 000	50 000	50 000	50 000											360 000
Electrical locker			2,000	4 000	4 000	4 000	4 000	4 000	4 000										26,000
TOTAL ELECTRICAL ON-CAR MATERIAL	0	0	258 000	227 000	179 500	149 000	138 000	138 000	25 000	0	0	0	0	0	0	0	0	0	1 110 500

MATERIAL ON-CAR

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
'ADER RAILCAR MATERIAL ON CAR 'ROJECT THUNDER																			
JTILITIES – HVAC IN CAR																			
Ducts – sheetmetal						15 000	10 000	10 000	10 000	10 000	10 000								65 000
Ducts – vertical						3 000	2 000	2 000	2 000	2 000	2 000								13 000
Insulation						3 000	2 000	2 000	2 000	2 000	2 000								13 000
Registers						9 000	6 000	6 000	6 000	6 000	6 000								39 000
Filters						3 000	2 000	2 000	2 000	2 000	2 000								13 000
Sliders						6 000	4 000	4 000	4 000	4 000	4 000								26 000
TOTAL HVAC ON-CAR MATERIAL	0	0	0	0	0	39 000	26 000	26 000	26 000	26 000	26 000	0	0	0	0	0	0	0	169 000
UTILITIES – PLUMBING																			
Consumables						6 000	4 000	4 000	4 000	8 000									26 000
Piping – Diner/lounge						35 000													35 000
Piping – Sleepers						80 000													80 000
Sinks – Diner/Lounge						14 000													14 000
Filtration system – spa car						20 000													20 000
Vacuum Toilets – Diner/Lounge						45 000													45 000
Sanitation vacuum system – Train						75 000													75 000
TOTAL PLUMBING ON-CAR MATERIAL	0	0	0	0	0	275 000	4 000	4 000	4 000	8 000	0	0	0	0	0	0	0	0	295 000
DOME																			
Dome glass production – diner/lounges				58 750					235 000										293 750
Dome glass production – sleepers					68 000					272 000									340 000
Side glass production – diner/lounges				6 250					25 000										31 250
Side glass production – sleepers					14 000					56 000									70 000
Rubber gaskets – Diner/lounges				3 125					12 500										15 625
Rubber gaskets – sleepers					8 000					32 000									40 000
Consumables								42 000											42 000
TOTAL – DOME	0	0	0	68 125	90 000	0	0	42 000	272 500	360 000	0	0	0	0	0	0	0	0	832 625
SKIN																			
FRP Tooling			25 000	25 000	25 000														75 000
FRP panel construction – side								70 000	112 000										182 000
FRP panel construction – end caps								20 000	32 000										52 000
FRP panel construction – special pieces								10 000	18 000										28 000
TOTAL FRP SKIN	0	0	25 000	25 000	25 000	0	0	100 000	160 000	0	0	0	0	0	0	0	0	0	335 000
INTERIORS																			
Carpet – Diner/Lounge							15 000	15 000	7 500										37 500
Carpet – Sleeper (hallways only)						3 000		21 000											24 000
Tables – Diner/Lounge							12 000	12 000	6 000										30 000
Cabinets – Diner/Lounge							25 000	25 000	12 500										62 500
Hottubs							45 000												45 000
Crew car refurbishment				20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000								160 000
Handrails							10 000	10 000	5 000										25 000
Proto sleeper mockup		50000	25000																75 000
Platform–lounge								15 000											15 000
Tile – Diner/Lounge							4 000	4 000	2 000										10 000
TOTAL INTERIORS ON-CARS	0	50 000	25 000	20 000	20 000	23 000	131 000	122 000	53 000	20 000	20 000	0	0	0	0	0	0	0	464 000
TOTAL DIRECT MATERIAL ON-CAR	2,750	58,750	322 150	516 275	367 650	537 150	562 150	449 400	546 900	449 000	46 000	0	0	0	0	0	0	0	3 862 175

MATERIAL ON-CAR

RADER RAILCAR SUBASSEMBLY FACILITY
PROJECT THUNDER

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
MATERIAL																			
FRAME (Tube steel wall & stairs construction)																			
Tube Steel (Walls	0	106 667	2 000	2 000	2 000	2,000	2,000	2,000											118 667
Stair steel	0	4 000	4 000	4 000	4 000	4 000	4 000	4 000											28 000
Stair steel bending/shearing	0	1 000	1 000	1 000	1 000	1 000	1 000	1 000											7 000
Freight	0	5 000	500	500	500	500	500	500											8 000
Welding supplies	0	1 000	1 000	1 000	1 000	1 000	1 000	1 000											7 000
Weldthrough primer supplies	0	500	500	500	500	500	500	500											3,500
TOTAL MATERIAL - FRAME (walls/stairs)		118 167	9 000	9 000	9 000	9 000	9 000	9 000	0	0	0	0	0	0	0	0	0	0	172,167
FRAME (Dome/End of car skin construction)																			
Tube Steel	0	53 333	2 000	2 000	2,000	2,000	2,000	2,000	2,000										67 333
Tube bending for 4 x 2	0	6 000	6 000	6 000	4 000	0	0	0	0										22,000
Tube bending for 8 x 2	0	6 000	6 000	6 000	4 000	0	0	0	0										22,000
Welding supplies	0	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000										8 000
Weldthrough primer	0	0	6 500	0	0	0	0	0	0										6 500
Sandblast	0	1 250	1 250	1 250	1 250	1 250	1 250	1 250	1 250										10 000
Cor Ten steel sheet end of car	0	2 800	0	0	2 800	0	0	0	0										5 600
Cor Ten steel sheet roof	0	5 600	0	0	5 600	0	0	0	0										11 200
Cor Ten steel sheet - dome floor	0	16 800	0	0	16 800	0	0	0	0										33 600
Freight	0	3 000	3 000	1 000	1 000	1 000	1 000	1 000	1 000										12,000
TOTAL MATERIAL - FRAME (Dome/End)	0	95 783	25 750	17 250	38 450	5 250	5 250	5 250	5 250	0	0	0	0	0	0	0	0	0	168 233
WALLS (Interior skins/walls insulation)																			
Cor Ten steel sheet interior skins	0	0	30 000	0		28 000													58 000
Insulation	0	0	10 500	0	0	9 000	0	0	0										19 500
Welding supplies	0	0	1 000	1,000	1 000	1 000	1 000	1 000	1 000										7 000
Weldthrough primer	0	0	6 500	0	0	0													6 500
Freight	0	0	3 000	0	0	1 000													4 000
TOTAL MATERIAL - WALLS (skins/walls)	0	0	51 000	1 000	1 000	39 000	1 000	1,000	1 000	0	0	0	0	0	0	0	0	0	95 000
FLOORS (Ply-metal)																			
Floor metal			17 500		17 500		17 500												52 500
Insulation			7 500		7 500		7 500												22,500
VHB tape			6 250		6 250		6 250												18 750
Plywood			10 000		10 000		10 000												30 000
Adhesive			5 000		5 000		5 000												15 000
Shearing			2 500		2 500		2 500												7 500
Other flooring materials			4 000		4 000		4 000												12,000
TOTAL MATERIAL - FLOORS	0	0	52,750	0	52,750	0	52,750	0	0	0	0	0	0	0	0	0	0	0	158 250

MATERIAL – SUBASSEMBLY

RADER RAILCAR SUBASSEMBLY FACILITY
PROJECT THUNDER

		OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
	MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
INTERIORS – BEDROOMS	per bedroom																			
Shower/toilet unit	7000				105 000	210 000	210 000	210 000	105 000											840 000
Bed units	1500				22 500	45 000	45 000	45 000	22 500											180 000
Closets/walls	500				7 500	15 000	15 000	15 000	7 500											60 000
Closet bath & sink	600				9 000	18 000	18 000	18 000	9 000											72 000
Seating couch	500				7 500	15 000	15 000	15 000	7 500											60 000
Seating chair	300				4 500	9 000	9 000	9 000	4 500											36 000
Sink unit	200				3 000	6 000	6 000	6 000	3 000											24 000
Sliding door	200				3 000	6 000	6 000	6 000	3 000											24 000
Shades dome	330				4 950	9 900	9 900	9 900	4 950											39 600
Table	200				3 000	6 000	6 000	6 000	3 000											24 000
Curtains hallside	100				1 500	3 000	3 000	3 000	1 500											12 000
Ceiling panel with lighting	400				6 000	12 000	12 000	12 000	6 000											48 000
HVAC room unit (see HVAC subassembly)					0	0	0	0	0											0
HVAC, music/P.A. Controls	500				7 500	15 000	15 000	15 000	7 500											60 000
Entry sliding door	200				3 000	6 000	6 000	6 000	3 000											24 000
TV/Video	500				7 500	15 000	15 000	15 000	7 500											60 000
Toilets	2000				30 000	60 000	60 000	60 000	30 000											240 000
Fabrics	500				7 500	15 000	15 000	15 000	7 500											60 000
Carpets	300				4 500	9 000	9 000	9 000	4 500											36 000
Hardware	150				2 250	4 500	4 500	4 500	2 250											18 000
TOTAL MATERIAL – BEDROOMS	15980	0	0	0	239 700	479 400	479 400	479 400	239 700	0	0	0	0	0	0	0	0	0	0	1 917 600
UTILITIES – HVAC																				
Undercar HVAC Units					420 000		420 000		420 000											1 260 000
In room HVAC units					80 000		80 000		80 000											240 000
TOTAL MATERIAL – HVAC		0	0	0	500 000	0	500 000	0	500 000	0	0	0	0	0	0	0	0	0	0	1 500 000
UTILITIES – TRUCKS																				
Axles				36 000	36 000		36 000													108 000
Bearings				24 000	24 000		24 000													72 000
Bearing work				8 400	8 400		8 400													25 200
Shipping				900	900		900													2 700
Bolster spring pads				4 320	4 320		4 320													12 960
Bearing box pads				1 200	1 200		1 200													3 600
Springs								64 000			80 000									144 000
Brakes				48 000	48 000		48 000													144 000
Brake Piping				6 000	6 000		6 000													18 000
Wheels				72 000	72 000		72 000													216 000
Other truck parts				24 000	24 000		24 000													72 000
Truck inspection – Amtrak								6 000					12 000							18 000
Truck inspection expenses								2 000					4 000							6 000
Draft gear repair parts				12 000	12 000		12 000													36 000
Diaphragm parts				6 000	6 000		6 000													18 000
Weldthrough primer				3 000	3 000		3 000													9 000
Welding supplies				3 000	3 000		3 000													9 000
Grab irons				3 000	3 000		3 000													9 000
TOTAL MATERIAL – TRUCKS		0	0	251 820	251 820	0	251 820	72 000	0	0	80 000	0	16 000	0	0	0	0	0	0	923 460
TOTAL SUBASSEMBLY MATERIAL		0	213 950	390 320	1 018 770	580 600	1 284 470	619 400	754 950	6 250	80 000	0	16 000	0	0	0	0	0	0	4 954 710

MATERIAL – SUBASSEMBLY

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
RADER RAILCAR SUBCONTRACTS PROJECT THUNDER																			
FLOORS (Ply-metal)																			
Stainless Steel Floor Pans - Kitchen					5 000														5 000
Stainless Steel Floor Pans - Platforms					2,000														2,000
Stainless Steel Floor Pans - Bathrooms					8 000														8,000
TOTAL FLOORS	0	0	0	0	15 000	0	0	0	0	0	0	0	0	0	0	0	0	0	15 000
UTILITIES - ELECTRIC																			
Electrical panels	0	0	0	48 000	48 000	48 000	48 000	48 000	48 000	48 000	48 000	48 000							432 000
Generator control panels								20 000											20 000
TOTAL UTILITIES - ELECTRICAL	0	0	0	48 000	48 000	48 000	48 000	68 000	48 000	48 000	48 000	48 000	0	0	0	0	0	0	452,000
UTILITIES - HVAC																			
HVAC unit plumbing							5 000	5 000	15 000	10 000	15 000	10 000	10 000	15 000					85 000
TOTAL UTILITIES - HVAC	0	0	0	0	0	0	5 000	5 000	15 000	10 000	15 000	10 000	10 000	15 000	0	0	0	0	85 000
UTILITIES - PLUMBING																			
Sewage tanks				1 500	4 500	4 500	4 500	4 500	4 500	3 000									27 000
Hot water storage tanks				1 500	4 500	4 500	4 500	4 500	4 500	3 000									27 000
Cold water storage tanks				1 500	4 500	4 500	4 500	4 500	4 500	3 000									27 000
TOTAL UTILITIES - PLUMBING	0	0	0	4 500	13 500	13 500	13 500	13 500	13 500	9 000	0	0	0	0	0	0	0	0	81 000
INTERIORS - OTHER THAN BEDROOMS																			
Cabinets								85 000											85 000
Cortan								30 000											30 000
Seats								250 000											250 000
Wallpapering								52 500											52 500
Carpeting								20 000											20 000
Paracube								25 000											25 000
Long Branch Saloon Bar								80 000											80 000
Dance floors								30 000											30 000
INTERIORS OTHER THAN BEDROOMS	0	0	0	0	0	0	0	437 500	0	0	0	0	0	0	0	0	0	0	437 500

SUBCONTRACTS

RADER RAILCAR SUBCONTRACTS
PROJECT THUNDER

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
KITCHEN/LIQUOR PREP																			
Stainless Steel Kitchen Counters					30 000														30 000
Kitchen Equipment							66,000												66,000
TOTAL KITCHEN/LIQUOR PREP	0	0	0	0	30 000	0	66 000	0	0	0	0	0	0	0	0	0	0	0	96 000
TEST																			
White glove cleaning									1 000		1 000	6 000	3,000	2,000		1 000	4 000		18 000
TOTAL TEST	0	0	0	0	0	0	0	0	1 000	0	1 000	6,000	3,000	2,000	0	1 000	4 000	0	18 000
TOTAL SUBCONTRACTS	0	0	0	52,500	106,500	61 500	132,500	524 000	77 500	67 000	64 000	84 000	13 000	17 000	0	1 000	4 000	0	1,184 500

SUBCONTRACTS

RADER RAILCAR
PROJECT THUNDER
PRODUCTION CASH FLOW

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
RAILCAR PURCHASES																			
Crew cars to be purchased by Rader @ $225 000 each for 3 cars	0	0	0	0	675 000	0	0	0	0	0	0	0	0	0	0	0	0	0	675 000
Shells owned by RRC																			
6 bi-level shells @ $95 000 each		570 000																	570 000
7 bi-level shells @ $95 000 each				665 000															665 000
1 baggage car shell @ $50 000				50 000															50 000
1 spa car shell @ $40 000				40 000															40 000
	0	570 000	0	755 000	675 000	0	0	0	0	0	0	0	0	0	0	0	0	0	2,000 000

RAILCAR PURCHASES

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18	TOTAL
SUMMARY OF CAR PLANT PRODUCTION WAGES																			
TOTAL WAGES IN CAR PLANT																			
SLEEPER #1	9 200	8 600	17 000	21 600	22 200	22 800	19 400	18 880	15 440	16 440	13 600	11 600	15 000	15 000	10 000	0	0	0	$234,760
DINER WITHOUT GALLEY	0	9 200	12 400	21 800	21 200	24 200	24 600	24 600	24 000	19 600	20 800	15 000	15 000	10 000	0	0	0	0	$242,400
DINER WITH GALLEY	0	9 200	8 800	17 000	26 000	26 200	24 400	24 200	22 000	22 600	23 500	14 800	15 000	15 000	10 000	0	0	0	$258,700
LOUNGE #1	0	3 200	9 200	9 200	21 800	21 200	22 600	26 200	24 600	24 000	21 600	14 800	15 000	15 000	10 000	0	0	0	$238,400
LOUNGE #2	0	3 200	9 200	10 600	21 400	20 000	22 800	26 200	24 600	24 000	21 600	14 800	15 000	15 000	10 000	0	0	0	$238,400
LOUNGE WITH LARGE BAR	0	0	3 200	9 200	13 000	20 000	19 200	24 600	24 200	24 600	24 000	22 400	14 600	15 000	15 000	10 000	0	0	$239 200
SLEEPER #2	0	0	0	10 600	20 800	22 200	23 800	24 400	24 400	21 440	15 440	18 280	14 800	15 000	15 000	10 000	0	0	$234 360
SLEEPER #3	0	0	0	0	15 200	20 400	21 400	21 600	23 900	23 900	24 720	23 640	18 600	15 000	15 000	10 000	0	0	$234 360
SLEEPER #4	0	0	0	0	15 200	20 400	21 400	21 600	23 900	23 900	21 440	21 320	25 200	15 000	15 000	10 000	0	0	$234 360
SLEEPER #5	0	0	0	0	0	11 600	24 000	21 400	21 600	23 900	23 900	21 440	21 320	25 200	15 000	15 000	10 000	0	$234 360
SLEEPER #6	0	0	0	0	0	11 600	24 000	21 400	21 600	23 900	23 900	21 440	23 440	23 080	15 000	15 000	10 000	0	$234 360
SLEEPER #7	0	0	0	0	0	0	11 600	24 000	21 400	21 600	23 900	27 180	31 840	32 840	15 000	15 000	10 000	0	$234 360
SLEEPER #8	0	0	0	0	0	0	11 600	24 000	21 400	21 600	23 900	23 900	35 120	32 840	15 000	15 000	10 000	0	$234 360
SPA CAR	0	3 200	9 200	4 400	25 200	14 200	21 800	20 700	18 500	15 400	10 400	10 000	15 000	15 000	0	0	0	0	$182,800
CREW CARS #1 - #3	0	0	0	0	0	23 800	24 200	18 800	20 000	23 600	24 200	18 800	20 000	23 600	24 200	18 800	20 000	0	$260 400
POWER BAG CAR	0	0	0	0	10 800	8 800	21 200	27 520	24 640	3 200	2 400	17 440	15 000	15 000	0	0	0	0	$144,000
LOCOMOTIVE MODS #1 - #2	0	0	0	0	0	0	0	0	0	0	1 600	4 800	4 000	800	2 000	0	0	0	$13 200
SLEEPER PROTO MOCKUP	0	7 000	7 000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$14 000
TRUCKS SHOP	1 600	10 100	10 100	19 700	19 700	17 300	20 500	19 700	17 300	17 300	15 000	22 100	18 200	13 000	4 400	0	0	0	$224 000
TOOL ROOM SHIP/REC. SECURITY	0	20 760	24 220	41 520	41 520	41 520	41 520	41 520	41 520	41 520	41 520	41 520	41 520	41 520	41 520	41 520	27 680	3 460	$815,880
TOTAL CAR PLANT WAGES	10 800	74 660	110 320	166 020	274 020	324 220	399 620	431 120	415 000	392 700	377 420	363 260	372 840	353 080	232 120	160 320	87 680	3 460	$4 548,660

CAR PLANT WAGES

	MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18	TOTAL
RADER RAILCAR SUBASSEMBLY FACILITY PROJECT THUNDER																				
DIRECT LABOR																				
FRAME LABOR (Tube steel wall & stars)	# of Cars	0		1	2	2	2	2	2	2										
Move steel from storage				200	400	400	400	400	400	400										2,800
Change fixtures/jigs as needed				200	400	400	400	400	400	400										2,800
Build stairs				1 600	3 200	3 200	3 200	3 200	3 200	3 200										20 800
Cut tube to length				3 600	7 200	7 200	7 200	7 200	7 200	7 200										46 800
Weld wall sections together on jig				1 600	3 200	3 200	3 200	3 200	3 200	3 200										20 800
Paint welds				600	1 200	1 200	1 200	1 200	1 200	1 200										7 800
Move wall sections & star to car base				200	400	400	400	400	400	400										2,800
TOTAL LABOR FRAME - (WALLS)		0	0	8 000	16 000	16 000	16 000	16 000	16 000	16 000	0	0	0	0	0	0	0	0	0	104 000
FRAME LABOR (Dome/End of car skin)	# of Cars			1	2	2	2	2	2	2										
Prep & paint floor sheeting with primer				1 000	2 000	2,000	2,000	2,000	2,000	2 000										13 000
Move steel from storage				400	800	800	800	800	800	800										5 200
Change fixtures/jigs as needed				200	400	400	400	400	400	400										2,600
Cut tube to length				2,400	4 800	4 800	4 800	4 800	4 800	4 800										31 200
Weld dome sections on jig				1 200	2 400	2,400	2,400	2,400	2,400	2,400										15 600
Paint welds				400	800	800	800	800	800	800										5 200
Move dome sections and sheets to car				400	800	800	800	800	800	800										5 200
TOTAL LABOR FRAME - (DOME & ENDS)		0	0	6 000	12 000	12,000	12 000	12,000	12,000	12 000	0	0	0	0	0	0	0	0	0	78 000
WALLS LABOR (Interior skins/walls insulation)					1	2	2	2	2	2	2									
Inside skins - cut/fit					5 600	11 200	11 200	11 200	11 200	11 200	11 200									72,800
Prep & paint skins with primer					1 600	3 200	3 200	3 200	3,200	3 200	3 200									20 800
TOTAL LABOR - WALLS		0	0	0	7 200	14 400	14 400	14 400	14 400	14 400	14 400	0	0	0	0	0	0	0	0	93 600
FLOORS (Ply-metal) LABOR				1	2	2	2	2	2	2										
Fabricate plymetal floors				3 000	6 000	6 000	6 000	6 000	6,000	6 000										39 000
TOTAL LABOR - FLOORS		0	0	3 000	6 000	6 000	6 000	6 000	6 000	6 000	0	0	0	0	0	0	0	0	0	39 000
INTERIORS - BEDROOMS - LABOR																				
Shower/toilet unit						49 412	49 412	49 412	49 412	49 412										247 059
Bed units						10 588	10 588	10 588	10 588	10 588										52,941
Closets/walls						3 529	3 529	3 529	3 529	3 529										17 647
Closet bath & sink						4 235	4 235	4 235	4 235	4 235										21 176
Seating couch						3 529	3 529	3 529	3 529	3 529										17 647
Seating chair						2,118	2,118	2,118	2,118	2,118										10 588
Sink unit						1 412	1 412	1 412	1 412	1 412										7 059
TOTAL LABOR BEDROOM ASSEM		0	0	0	0	74 824	74 824	74 824	74 824	74 824	0	0	0	0	0	0	0	0	0	374 118
UTILITIES - HVAC LABOR	Ultras/Spa	0	0	0	0	0	1	1	1	1	1	1	0	0	0					
	Sleepers	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0				
HVAC Unit construction-undercar (2 units/sleeper, 4 units/lounge/diner/spa)		0	0	0	0	2,400	7 200	7 200	7,200	7 200	7 200	7 200	2,400	0	0	0	0	0	0	48 000
HVAC Unit Construction - bedrooms (15 units / sleeper car)		0	0	0	0	6 000	6 000	7 000	7 000	7 000	7 000	7 000	7 000	0	0	0	0	0	0	54 000
TOTAL LABOR - UTILITIES - HVAC		0	0	0	0	8 400	13 200	14 200	14 200	14 200	14 200	14 200	9 400	0	0	0	0	0	0	102,000
TOTAL LABOR FOR SUBASSEMBLY		0	0	17 000	41 200	131 624	136 424	137 424	137 424	137 424	28 600	14 200	9 400	0	0	0	0	0	0	$790 718

SUMMARY LABOR – SUBASSEMBLY

		OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
	MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
RADER RAILCAR SUBASSEMBLY FACILITY PROJECT THUNDER																				
SUBASSEMBLY FACILITY COSTS																				
Subassembly Plant Personnel/burden																				
First Shift																				
Plant Manager	$40 000 per year		0	6 500	6 500	6 500	6 500	6 500	6 500	6 500	6 500	6 500	6 500	6 500	6 500	6 500	6 500	0	0	91 000
Plant Asst Mgr	$20/hr		4 507	4 507	4 507	4 507	4 507	4 507	4 507	4 507	4 507	4 507	4 507	4 507	0	0	0	0	0	54 080
Shift Supervisor	$20/hr		4 507	4 507	4 507	4 507	4 507	4 507	4 507	4 507	4 507	4 507	4 507	4 507	0	0	0	0	0	54 080
Security/OSHA/Safety	$15/hr		3 380	3 380	3 380	3 380	3 380	3 380	3 380	3 380	3 380	3 380	3 380	3 380	3 716	3 716	3 716	0	0	51 714
Inventory control	$12/hr		2 704	2 704	2 704	2 704	2 704	2 704	2 704	2 704	2 704	2 704	2 704	2 704	2 974	2 974	2 974	2 974	2 974	47 320
Truck driver	$8/hr		0	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 983	1 983	1 983	1 983	1 983	29 744
Expiditor/ship/rec/tool	$8/hr		0	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 803	1 803	0	0	25 237
Second Shift																				
Plant Asst Mgr	$22/hr		0	0	4 957	4 957	4 957	4 957	4 957	4 957	4 957	4 957	0	0	0	0	0	0	0	39 658
Security/OSHA/Safety	$17/hr		3 831	3 831	3 831	3 831	3 831	3 831	3 831	3 831	3 831	0	0	0	0	0	0	0	0	34 478
Inventory control	$13/hr		2 929	2 929	2 929	2 929	2 929	2 929	2 929	2 929	2 929	2 929	0	0	0	0	0	0	0	29 293
Truck driver	$10/hr		0	2 253	2 253	2 253	2 253	2 253	2 253	2 253	2 253	0	0	0	0	0	0	0	0	18 027
Expiditor/ship/rec/tool	$8.80/hr		0	0	1 983	1 983	1 983	1 983	1 983	1 983	1 983	0	0	0	0	0	0	0	0	13 881
Burden (Taxes medical WC)			6 557	10 265	11 752	11 752	11 752	11 752	11 752	11 752	11 752	8 927	7 561	7 561	5 093	5 093	5 093	1 487	1 487	142 389
Utilities	Elect, gas water		6 000	7 000	8 000	8 000	9 000	8 000	6 000	5 000	4 000	3 000	4 000	4 000	5 000	5 000	6 000	6 000	5 000	100 000
Trash			500	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	1 000	500	500	500	500	500	500	500	21 000
Local Phone			500	500	500	500	500	500	500	500	500	500	500	500	500	500	250	250	250	7 750
Long distance			500	750	1000	1500	2000	2000	2000	2000	2000	1500	1000	750	500	250	100	100	100	18 050
Truck expense			500	500	750	750	1000	1000	1000	1000	1000	750	750	750	500	500	500	250	250	11 750
Tools			500	500	750	750	1000	1000	1000	1000	1000	750	750	750	500	500	500	250	250	11 750
Safety/medical			500	500	750	750	1000	1000	1000	1000	1000	750	750	750	500	500	500	250	250	11 750
Testing			500	1500	2000	4000	2000	1000	1000	1000	500	500	250	250	250	250	0	0	0	15 000
Rent	52 000 sq ft @ $3/ft		26 000	13 000	13 000	13 000	13 000	13 000	13 000	13 000	13 000	13 000	13 000	13 000	13 000	13 000	13 000	13 000	0	221 000
Security deposits	Rent/sec		10 000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	(10 000)	0
RE Taxes	$36 000 per year		3 000	3 000	3 000	3 000	3 000	3 300	3 300	3 300	3 300	3 300	3 300	3 300	3 300	3 300	3 300	3 300	3 300	54 600
Insurance	$30 000 per year		2 500	2 500	2 500	2 500	2 500	2 500	2 500	2 500	2 500	2 500	2 500	2 500	2 500	2 500	2 500	3 000	3 000	43 500
Fuel	For trucks forks		400	400	400	400	400	400	400	400	400	400	400	200	200	200	200	100	100	5 400
Repairs/maint			500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	250	250	8 000
Office	Supplies		1 500	1 500	1 500	1 500	1 500	1 500	1 500	1 500	1 500	1 500	1 500	1 500	1 500	1 500	1 500	1 500	1 500	25 500
TOTAL SUBASSEMBLY FACILITY COSTS		0	81 815	78 631	89 558	93 058	92 308	90 608	88 608	87 608	86 108	72 988	82 483	82 013	51 321	51 071	51 421	35 195	11 195	1 186 950

FACILITY COSTS – SUBASSEMBLY

RADER RAILCAR SUBASSEMBLY FACILITY
PROJECT THUNDER

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
EQUIPMENT																			
Welding Machines (10)				35 000															35 000
Forklifts (3)				60 000															60 000
Brake				30 000															30 000
Shear				30 000															30 000
Tractor with two 40' flatbeds				25 000															25 000
Jigs/fixtures				10 000															10 000
Air compressor				10 000															10 000
Cold saws (2)				6 000															6 000
Roller tables				5 000															5 000
Band saw				1 000															1 000
Carts (10)				5 000															5 000
Tools				16 000															16 000
Equipment rental			20 000	20 000	5 000	5 000	5 000	3 000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000			74 000
Office Equipment				10 000															10 000
TOTAL EQUIPMENT RENTAL PURCHASE	0	0	20 000	263 000	5 000	5 000	5 000	3 000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	0	0	317 000
LEASEHOLD IMPROVEMENTS																			
Small Paint Booth		25 000	25 000																50 000
Electrical Improvement		25 000	25 000																50 000
Security system		10 000	0																10 000
Office improvements			5 000																5 000
Air compressor and lines		25 000	25 000																50 000
TOTAL LEASEHOLD IMPROVEMENTS	0	85 000	80 000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	165 000

EQUIP/LEASEHOLDS – SUBASSEMBLY

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
PROJECT THUNDER																			
CAR PLANT UTILITIES																			
Gas	1 000	3 000	5 000	7 000	7 000	5 000	4 000	3 000	2 000	1 000	1 000	1 000	2 000	4 000	8 000	8 000	8 000	8 000	78 000
Electricity	2,000	2,000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	60 000
Water	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	350	350	350	5 550
Compressed air	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	9 000
Trash removal	1 000	1 500	2 000	2,000	2 000	2,000	2,000	2,000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	24 500
Local Phone	1 000	1 300	1 300	1 600	1 600	2,000	2,000	2,000	2,000	2,000	2 000	2,000	2,000	2,000	1 500	1 500	1 500	1 200	30 500
Long Distance	600	800	1 000	1 300	1 500	2,000	2,400	2,800	3 000	3 400	4 000	4 500	4 000	4 000	3 500	3 500	3 000	2,500	47 800
Janitorial	250	500	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	12,750
Security	200	400	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	10 200
Fedex/UPS	500	750	1 000	1 000	1 000	1 000	1 000	1 000	1,000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	17 250
Thunder credit	(735)	(1 105)	(1 645)	(1 905)	(1 925)	(1 815)	(1 755)	(1 695)	(1 515)	(1 455)	(1 415)	(1 465)	(1 515)	(1 715)	(1 815)	(2,020)	(1 970)	(1 890)	(29 355)
TOTAL CAR PLANT UTILITIES	6 615	9 945	14 805	17 145	17 325	16 335	15 795	15 255	13 635	13 095	12,735	13 185	13 635	15 435	16 335	18 180	17 730	17 010	264,195
CAR PLANT EXPENSES																			
Truck/Auto	500	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	17 500
Shop tools expense	500	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	17 500
Safety and medical	0	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	17 000
Rent – car plant	10 600	10 600	12,750	12 750	12,750	12,750	12,750	12,750	12,750	12 750	12 750	12,750	12,750	12,750	12,750	12,750	12,750	12,750	225 200
Taxes – Real Estate	2,500	2,500	2 500	2 500	2,500	2,500	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 300	3 300	51 600
Taxes – Personal Property	800	800	900	1 000	1 100	1 100	833	833	833	833	833	833	833	833	833	833	833	833	15 700
Shop supplies	3 000	5 000	7 000	7 000	7 000	7 000	7 000	7 000	7 000	7 000	7 000	7 000	7 000	7 000	7 000	4 000	3 000	2,000	108 000
Travel lodging meals	300	500	500	750	750	1 000	1 000	1 500	1 500	2 000	2,000	3 000	3 000	4 000	4 000	5 000	5 000	6 000	41 800
Books/manuals misc	500	1 000	1 000	1 000	500	500	500	500	500	500	500	0	0	0	0	0	0	0	7 000
Repair and maint. – tools equip general	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	18 000
Thunder credit	(1 970)	(2,440)	(2,865)	(2,900)	(2,860)	(2,885)	(2,908)	(2,958)	(2,958)	(3 008)	(3 008)	(3 058)	(3 058)	(3,158)	(3,158)	(2,958)	(2,868)	(2,868)	(51 930)
TOTAL CAR PLANT EXPENSES	17 730	21 960	25 785	26 100	25 740	25 965	26 175	26 625	26 625	27 075	27 075	27 525	27 525	28 425	28 425	26 625	25 995	25 995	467 370
TOTAL CAR PLANT FACILITY COSTS	24 345	31 905	40 590	43 245	43 065	42,300	41 970	41 880	40 260	40 170	39 810	40 710	41 160	43 860	44 760	44 805	43,725	43,005	731 565

CAR PLANT FACILITY COSTS

PROJECT THUNDER

EQUIPMENT/LEASEHOLDS – CAR PLANT

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18	TOTAL
Forklifts (3)		20 000	40 000																60 000
Tools		10 000	10 000																20 000
Lifts		12,000	12,000																24 000
Welders		26,250	26 250																52 500
Panel track			25 000																25 000
Fencing of yard			20 000																20 000
Grading, leveling yard			10 000																10 000
Spur			25 000	25 000															50 000
Trucks			25 000																25 000
Panel truck				12,000															12,000
Cold Saws			3,000																3 000
Metal band saw			1 000																1 000
Office leaseholds		13 000																	13 000
Office furniture		10 000	10 000	10 000															30 000
Computer system – Administration			40 000																40 000
Computer system – Engineering		40 000																	40 000
Equipment rental – RRC equipment		20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	340 000
Equipment rental – other		2,000	3 000	4 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	4 000	3,000	2,000	73,000
TOTAL EQUIP/LEASHOLDS – CAR PLANT	0	153 250	270 250	71 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	24 000	23,000	22,000	838 500

EQUIPMENT/LEASEHOLDS – CAR PLANT

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96	TOTAL
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
PROJECT THUNDER																			
PROJECT THUNDER																			
ADMINISTRATIVE SALARIES																			
Administration																			
President	16 667	16 667	16 667	16 667	16 667	16 667	16 667	16 667	16 667	16 667	16 667	16 667	16 667	16 667	16 667	16 667	16 667	16 667	300 000
Executive Vice President	3 000	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12 500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12 500	12,500	215 500
VP/Chief Financial Officer	9 583	9 583	9 583	9 583	9 583	9 583	9 583	9 583	9 583	9 583	9 583	9 583	9 583	9 583	9 583	9 583	9 583	9 583	172,500
Executive asst.		2,917	2,917	2 917	2,917	2 917	2,917	2,917	2,917	2,917	2,917	2 917	2,917	2,917	2,917	2 917	2,917	2,917	49 583
Receptionist	1 733	1 733	1 733	1 733	1 733	1 733	1,733	1,733	1 733	1 733	1 733	1,733	1,733	1 733	1 733	1 733	1 733	1 733	31 200
Marketing & Communications																			
Vice President – Sales	5 000	7 083	7 083	7 083	7 083	7 083	7 083	7 083	7 083	7 083	7 083	7 083	7 083	7 083	7 083	7 083	7 083	7 083	125 417
Communications manager	3,750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3 750	3,750	3 750	3,750	3 750	3,750	3,750	3 750	3 750	3 750	67 500
Sales asst.		2,083	2,083	2,083	2,083	2,083	2,083	2,083	2,083	2,083	2,083	2,083	2,083	2,083	2,083	2,083	2,083	2,083	35 417
Burden	9 933	14 079	14 079	14 079	14 079	14 079	14 079	14 079	14 079	14 079	14 079	14 079	14 079	14 079	14 079	14 079	14 079	14 079	249 279
Other related expenses	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	18,000
TOTAL ADMINISTRATIVE SALARIES	50 667	71 396	71 396	71 396	71 396	71,396	71,396	71 396	71 396	71 396	71 396	71 396	71 396	71 396	71 396	71 396	71 396	71 396	1 284 396
ADMINISTRATIVE EXPENSE																			
Auto expense	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	9 000
Office expense	500	500	750	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	16 750
Computer expense	500	500	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	17 000
Rental/leased equipment	0	500	750	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	16 250
Licenses	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	3,600
Entertainment	500	750	750	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	17 000
Travel lodging meals	8 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	93 000
Dues/subscriptions	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	3 600
Books/manuals	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	9 000
Insurance	2,500	2,500	2 500	2,500	6 000	6 000	6 000	6 000	6 000	6 000	6 000	6 000	6 000	6 000	6 000	6 000	6 000	7 000	95 000
Professional services	1 000	10 000	10 000	10 000	10 000	5 000	5 000	2,000	2,000	2 000	2 000	3 000	4 000	5 000	5 000	10 000	10 000	5 000	101 000
Thunder credit	(6 507)	(9 255)	(9 355)	(9 430)	(9 780)	(9 280)	(9 280)	(8,980)	(8,980)	(8,980)	(8 980)	(9 080)	(9 180)	(9 280)	(9 280)	(9 780)	(9 780)	(9 380)	(164 560)
TOTAL ADMINISTRATIVE EXPENSE	7 893	11 895	12,795	13 470	16 620	12,120	12,120	9 420	9 420	9 420	9 420	10 320	11,220	12,120	12,120	16 620	16 620	13,020	216,640
ADMINISTRATIVE SALARIES AND EXPENSES	58 560	83 291	84 191	84 866	88 016	83 516	83,516	80 816	80 816	80 816	80 816	81,716	82,616	83 516	83 516	88 016	88 016	84 416	1 481 036

ADMINISTRATIVE SALARIES AND EXPENSES

SCHEDULE D

TRACK RIGHT NEGOTIATION AUTHORIZATION

This schedule consists of the 1 pages attached hereto.

PHILIP MORRIS
U.S.A.
120 PARK AVENUE, NEW YORK, N Y 10017-5592 TELEPHONE (212) 880-5000

November 7, 1994

Mr. Thomas G. Rader, President
RADER RAILCAR, INC.
10700 East 40th Avenue
Denver, Colorado 80239

Re: Track Rights Negotiation

Dear Mr. Rader:

As requested, this details the elements of the Project Thunder promotion you are free to disclose in the course of negotiating track rights:

- Luxury train trip beginning Summer, 1996
- Consumer promotion
- Sponsored by Philip Morris U.S.A. (tobacco division)

Even if we cannot obtain signed confidentiality agreements, please communicate that this information should be kept confidential, limited to as few people inside their company as possible, and only released outside on a need-to-know basis (with our advance approval).

Please call with any questions.

Sincerely yours,

Ann von Germeten

Ann von Germeten
Brand Manager, Promotions

cc: Steve Piskor
Virginia Murphy
Deane Gross

SCHEDULE E

PRODUCTION SCHEDULE

This schedule consists of the 37 pages attached hereto.

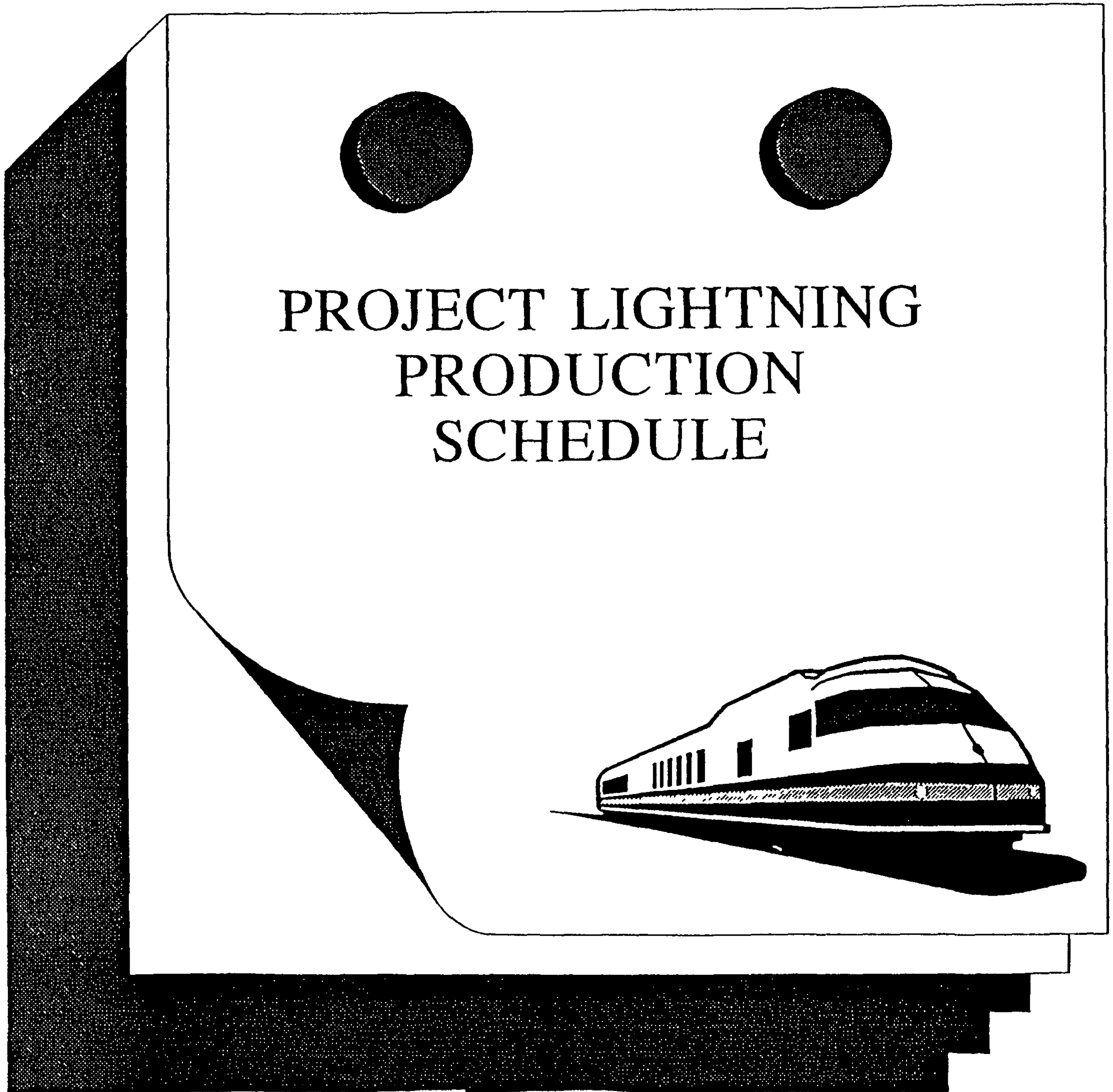

PROJECT LIGHTNING
PRODUCTION
SCHEDULE

TABLE (ƆNTENTS

Note: From time to time throughout the production schedule, the LT (late finishes) of test phases are shown in the same month as the late finish date of the other phases. It should be noted that the test phase can and will proceed independent of other phases. Also, this production schedule is stated in months. It is anticipated that the test phase will be only two weeks in length. So, for example on the Spa Car, on page 42, the Interiors, Dome and Skin phases could late finish in the first half of October, while the test phase could be a late finish at the end of October.

MILESTONES LATE FINISHES DEFAULTS

MILESTONES

MONTH #	PAGES	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
ADMINISTRATION & ENGINEERING	4-9	0	8	5	4	11	3	0	1	0	1	1	3	2	2	0	0	0	0
SLEEPER #1	10-13	0	1	1	1	2	1	1	1	1	3	1	2	0	0	0	0	0	0
DINER WITHOUT GALLEY	14-17	0	0	2	1	0	2	1	5	1	1	3	0	0	0	0	0	0	0
DINER WITH GALLEY	18-19	0	0	2	1	0	2	1	1	1	2	4	2	0	0	0	0	0	0
LOUNGE #1	20-21	0	0	0	2	1	0	2	1	5	0	3	2	0	0	0	0	0	0
LOUNGE #2	22-23	0	0	0	2	1	0	2	1	5	0	3	2	0	0	0	0	0	0
LOUNGE WITH LARGE BAR	24-25	0	0	0	0	2	1	0	2	1	5	0	3	2	0	0	0	0	0
SLEEPER #2	26-27	0	0	0	0	2	1	0	3	0	5	0	2	2	0	0	0	0	0
SLEEPER #3	28-29	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0	0	0	0
SLEEPER #4	30-31	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0	0	0	0
SLEEPER #5	32-33	0	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0	0	0
SLEEPER #6	34-35	0	0	0	0	0	1	1	1	0	3	2	3	0	4	0	0	0	0
SLEEPER #7	36-37	0	0	0	0	0	0	1	1	1	0	3	2	4	3	0	0	0	0
SLEEPER #8	38-39	0	0	0	0	0	0	1	1	1	0	3	2	4	3	0	0	0	0
TRUCKS SHOP	40-41	0	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3
SPA CAR	42-43	0	0	0	1	1	0	2	1	5	4	0	0	0	0	0	0	0	0
CREW CARS #1-#3	44-47	0	0	0	0	0	2	3	3	1	2	4	3	1	2	5	6	2	0
POWER BAG CAR	48-52	0	0	0	0	0	1	2	3	3	2	1	3	0	0	0	0	0	0
LOCOMOTIVE MODS #1-#2	53-54	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
SLEEPER PROTO MOCKUP	55-56	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOOL ROOM SHP/REC, SECURITY	57-58	0	6	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PURCHASING & SUBCONTRACTING	59-60	1	5	9	6	15	9	1	0	0	0	0	0	0	0	0	0	0	0
SUBASSEMBLY	61-62	0	0	0	0	0	0	0	0	4	1	0	1	0	0	0	0	0	0
TOTAL MILESTONES		1	21	22	25	39	28	24	29	38	39	39	38	26	20	9	9	5	3

SUMMARY MILESTONES

LATE FINISHES	PAGES	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
	MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ADMINISTRATION & ENGINEERING	4-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SLEEPER #1	10-13	0	0	0	1	1	1	2	1	1	1	1	3	1	2	0	0	0	0
DINER WITHOUT GALLEY	14-17	0	0	0	0	2	1	0	2	1	5	1	1	3	0	0	0	0	0
DINER WITH GALLEY	18-19	0	0	0	0	2	1	0	2	1	1	1	2	4	2	0	0	0	0
LOUNGE #1	20-21	0	0	0	0	0	2	1	0	2	1	5	0	3	2	0	0	0	0
LOUNGE #2	22-23	0	0	0	0	0	2	1	0	2	1	5	0	3	2	0	0	0	0
LOUNGE WITH LARGE BAR	24-25	0	0	0	0	0	0	2	1	0	2	1	5	0	3	2	0	0	0
SLEEPER #2	26-27	0	0	0	0	0	0	2	1	0	3	0	5	0	2	2	0	0	0
SLEEPER #3	28-29	0	0	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0	0
SLEEPER #4	30-31	0	0	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0	0
SLEEPER #5	32-33	0	0	0	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0
SLEEPER #6	34-35	0	0	0	0	0	0	0	1	1	1	0	3	2	3	0	4	0	0
SLEEPER #7	36-37	0	0	0	0	0	0	0	0	1	1	1	0	3	2	4	3	0	0
SLEEPER #8	38-39	0	0	0	0	0	0	0	0	1	1	1	0	3	2	4	3	0	0
TRUCKS SHOP	40-41	0	1	1	1	2	2	3	3	3	3	3	3	3	3	3	3	3	3
SPA CAR	42-43	0	0	0	0	0	1	1	0	2	1	5	0	4	0	0	0	0	0
CREW CARS #1-#3	44-47	0	0	0	0	0	0	0	2	3	3	1	3	2	3	1	3	10	0
POWER BAG CAR	48-52	0	0	0	0	0	0	0	1	2	3	3	2	1	3	0	0	0	0
LOCOMOTIVE MODS #1-#2	53-54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
SLEEPER PROTO MOCKUP	55-56	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
TOOLROOM SHP/REC SECURITY	57-58	0	0	0	6	1	5	0	0	0	0	0	0	0	0	0	0	0	0
PURCHASING & SUBCONTRACTING	59-60	0	0	1	5	9	6	15	9	1	0	0	0	0	0	0	0	0	0
SUBASSEMBLY	61-62	0	0	0	0	0	0	0	0	0	0	4	1	0	1	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL LATE FINISHES		0	1	2	13	18	21	29	26	24	28	38	35	40	35	24	19	14	3

SUMMARY LATE FINISHES

SUMMARY DEFAULTS

DEFAULTS	PAGES	OCT 94 (1)	NOV 94 (2)	DEC 94 (3)	JAN 95 (4)	FEB 95 (5)	MAR 95 (6)	APR 95 (7)	MAY 95 (8)	JUN 95 (9)
ADMINISTRATION & ENGINEERING	4-9	0	1	1	3	1	2	0	0	0
SLEEPER #1	10-13	0	0	0	0	1	1	1	2	1
DINER WITHOUT GALLEY	14-17	0	0	0	0	0	2	1	0	2
DINER WITH GALLEY	18-19	0	0	0	0	0	2	1	0	2
LOUNGE #1	20-21	0	0	0	0	0	0	2	1	0
LOUNGE #2	22-23	0	0	0	0	0	0	2	1	0
LOUNGE WITH LARGE BAR	24-25	0	0	0	0	0	0	0	2	1
SLEEPER #2	26-27	0	0	0	0	0	0	0	2	1
SLEEPER #3	28-29	0	0	0	0	0	0	0	1	1
SLEEPER #4	30-31	0	0	0	0	0	0	0	1	1
SLEEPER #5	32-33	0	0	0	0	0	0	0	0	1
SLEEPER #6	34-35	0	0	0	0	0	0	0	0	1
SLEEPER #7	36-37	0	0	0	0	0	0	0	0	0
SLEEPER #8	38-39	0	0	0	0	0	0	0	0	0
TRUCKS SHOP	40-41	0	0	0	0	0	1	1	2	2
SPA CAR	42-43	0	0	0	0	0	0	1	1	0
CREW CARS #1-#3	44-47	0	0	0	0	0	0	0	0	2
POWER BAG CAR	48-52	0	0	0	0	0	0	0	0	1
LOCOMOTIVE MODS #1-#2	53-54	0	0	0	0	0	0	0	0	0
SLEEPER PROTO MOCKUP	55-56	0	0	0	0	0	1	0	0	0
TOOL ROOM SHP/REC SECURITY	57-58	0	0	0	0	6	1	5	0	0
PURCHASING & SUBCONTRACTING	59-60	0	0	0	1	5	9	6	15	9
SUBASSEMBLY	61-62	0	0	0	0	0	0	0	0	0
TOTAL DEFAULTS		0	1	1	4	13	19	20	28	25
CUMULATIVE DEFAULTS		0	1	2	6	19	38	58	86	111

DEFAULTS	PAGES	JUL 95 (10)	AUG 95 (11)	SEP 95 (12)	OCT 95 (13)	NOV 95 (14)	DEC 95 (15)	JAN 96 (16)	FEB 96 (17)	MAR 96 (18)
ADMINISTRATION & ENGINEERING	4-9	0	0	0	0	0	0	2	0	1
SLEEPER #1	10-13	0	0	0	2	1	2	0	0	0
DINER WITHOUT GALLEY	14-17	1	1	1	1	3	0	0	0	0
DINER WITH GALLEY	18-19	1	0	0	1	3	2	0	0	0
LOUNGE #1	20-21	2	1	1	0	3	2	0	0	0
LOUNGE #2	22-23	2	1	1	0	3	2	0	0	0
LOUNGE WITH LARGE BAR	24-25	0	2	1	1	0	3	2	0	0
SLEEPER #2	26-27	0	3	0	1	0	2	2	0	0
SLEEPER #3	28-29	1	0	3	0	1	1	3	0	0
SLEEPER #4	30-31	1	0	3	0	1	1	3	0	0
SLEEPER #5	32-33	1	1	0	3	0	1	1	3	0
SLEEPER #6	34-35	1	1	0	3	0	1	1	3	0
SLEEPER #7	36-37	1	1	1	0	3	0	2	3	0
SLEEPER #8	38-39	1	1	1	0	3	0	2	3	0
TRUCKS SHOP	40-41	2	2	2	2	2	3	3	3	3
SPA CAR	42-43	2	1	1	0	4	0	0	0	0
CREW CARS #1-#3	44-47	3	3	1	3	2	3	1	3	6
POWER BAG CAR	48-52	2	3	3	2	1	3	0	0	0
LOCOMOTIVE MODS #1-#2	53-54	0	0	0	0	0	0	1	0	1
SLEEPER PROTO MOCKUP	55-56	0	0	0	0	0	0	0	0	0
TOOL ROOM SHP/REC SECURITY	57-58	0	0	0	0	0	0	0	0	0
PURCHASING & SUBCONTRACTING	59-60	1	0	0	0	0	0	0	0	0
SUBASSEMBLY	61-62	0	0	4	1	0	1	0	0	0
TOTAL DEFAULTS		22	21	23	20	30	27	23	18	11
CUMULATIVE DEFAULTS		133	154	177	197	227	254	277	295	306

Project Thunder Preliminary Production Schedule
ENGINEERING AND ADMINISTRATION

Event / Month	Oct-94 1	Nov-94 2	Dec 94 3	Jan-95 4	Feb-95 5	Mar 95 6	Apr 95 7	May 95 8	Jun-95 9	Jul-95 10	Aug 95 11	Sep-95 12	Oct 95 13	Nov 95 14	Dec 95 15	Jan-96 16	Feb-96 17	Mar 96 18	
ADMINISTRATION																			
Final Production Schedule			MS																
Reconfirm Delivery Date						D													
Hire Personnel					D														
Manufacturing Personnel				MS															
VP Manufacturing		C																	
General Superintendent																			
QA Manager																			
QA Asst Manager																			
Car Plant Manager - 1st Shift																			
Car Plant Manager - 2nd Shift																			
Production Control Manager																			
Production Control Asst																			
Engineering Personnel				MS															
VP Engineering																			
Structural Engineer																			
Mechanical Engoneer	C																		
Electrical Engineer																			
Design/Drafting Personnel				MS															
VP Design	C																		
CAD Drafters (4)																			
Administrative Personnel			MS																
Account Manager																			
Job Costing/Billing																			
Accounts Payable(2)																			
Purchasing Manager	C																		
Purchasing Secretary																			
Personnel Manager		C																	
Personnel Secretary																			
Subassembly Plant Personnel																			
Plant Manager			MS																
Plant Asst Manager - 1st Shift																			
Plant Asst Manager - 2nd Shift																			
Subassembly Plant																			
Facility Lease		D																	
Leasehold Improvements			D																
Small Paint Booth																			
Electrical Improvements																			
Security System																			
Office Improvements																			
Air Compressor and Lines																			
Equipment Purchase/Installation				D															
Welding Machines (10)																			
Forklifts (3)																			
Brake																			
Shear																			
Tractor with two 40' flatbeds																			
Jigs/Fxtures																			
Air Compressor																			
Cold Saws (2)																			
Roller Tables																			
Band Saw																			
Carts (10)																			
Tools																			
Equipent Rentals Placed																			
Office Equipment																			

MS = PRODUCTION MILESTONE, LF = LATE FINISH, D = DEFAULT, A = AGREEMENT SHIP DATE, C = COMPLETED, PM = OWNER S DECISION REQUIRED

Project Thunder Preliminary Production Schedule
ADMINISTRATION AND ENGINEERING

Event \ Month	Oct-94 1	Nov-94 2	Dec-94 3	Jan-95 4	Feb-95 5	Mar 95 6	Apr 95 7	May-95 8	Jun-95 9	Jul-95 10	Aug-95 11	Sep-95 12	Oct-95 13	Nov-95 14	Dec-95 15	Jan-96 16	Feb-96 17	Mar 96 18	
ADMINISTRATION (Continued)																			
Car Plant																			
Leasehold Improvements				D															
Welding Machines																			
Panel rack																			
Fencing of Yard																			
Grading/Leveling Yard																			
Spur																			
Office Leaseholds																			
Equipment Purchase/Installation				D															
Forklifts (3)																			
Tools																			
Lifts																			
Trucks																			
Panel Truck																			
Cold Saws																			
Metal Band Saw																			
Office Furniture																			
Equipment Rentals Placed																			
ENGINEERING																			
General Arrangements		MS																	
RRC Design (Excluding Staff Cars)	C																		
Staff Cars		MS																	
PM Review & Approval		PM																	
RRC Design Modifications		MS																	
ADA Acess Plans		PM																	
PM Final Approval		PM																	
Public Address System		PM																	
Exterior Paint and Graphics Scheme			PM																
RRC Full Size Mark Out																			
Full Size Mark Out Approval				PM															
Color Sample Approvals				PM															
Car Systems																			
Accesses																			
Trucks																			
Diaphrams																			
Exterior																			
Skins					MS														
Glazing																			
FRP Tooling Design					MS														
Locomotive Engineering & Modifications						D													
Nose & Skin Design																			
Structural Design																			
FRA Approval																			
Bid FRP Nose & Skin Fabrication																			
Award FRP Nose & Skin Fabrication					MS														
Locomotive #1																			
Receive Nose & Skin at RRC										MS									
Install Nose & Skin																			
Paint Nose & Skin																			
Test													MS						
Delivery Locomotive #1													MS			D			
Locomotive #2																			
Receive Nose & Skin at RRC											MS								
Install Nose & Skin																			
Paint Nose & Skin																			
Test														MS					
Delivery Locomotive #2														MS				D	

MS = PRODUCTION MILESTONE, LF = LATE FINISH D = DEFAULT, A = AGREEMENT SHIP DATE, C = COMPLETED, PM = OWNER'S DECISION REQUIRED

Project Thunder Preliminary Production Schedule
ADMINISTRATION AND ENGINEERING

Event / Month	Oct-94 1	Nov-94 2	Dec 94 3	Jan-95 4	Feb-95 5	Mar-95 6	Apr 95 7	May-95 8	Jun-95 9	Jul-95 10	Aug-95 11	Sep-95 12	Oct-95 13	Nov-95 14	Dec 95 15	Jan-96 16	Feb-96 17	Mar 96 18
ENGINEERING (Continued)																		
Power & Baggage Car Engineering & Production												MS				D		
Fuel System Design						MS												
Structural Design				MS														
Controls/Switchgear Design						MS												
Air/Exhaust Systems Design					MS													
Waste Heat System Design					MS													
Purchase Gen Sets & Controls																		
Gen Sets & Controls Received																		
Gen Sets & Controls Installed								MS										
Prepare Car																		
Structural Modifications																		
Install Fuel/Air/Control/Elec Distribution Systems																		
Paint																		
Test Complete												MS						
Delivery Power & Baggage Car												MS						
Sleeper Cars Engineering					MS													
General Arrangements																		
RRC Design	C																	
PM Review & Approval		PM																
RRC Design Modifications		C																
PM Final Approval		PM																
Structural Design & Analysis																		
Preliminary Structure	C																	
Preliminary FEA		C																
Modifications																		
Final Design			MS															
Final FEA			MS															
Sleeper Car Systems																		
HVAC																		
Water																		
Sewage																		
Electrical																		
Sleeper Car Interior																		
Mock-Up																		
Materials Purchased																		
Construction																		
PM Review & Approval - Layout			PM															
PM Review & Approval - Fixtures/Controls				PM														
Deluxe Cabin Arrangement		PM																
Deluxe Cabin Interior Design Plan					PM													
Hallways Stairs Public Areas Design Plan					PM													
Final Interior Designs																		
Bedroom																		
Bathroom																		
Furnishings																		
Fabrics																		
Hardware																		
PM Review & Approval					PM													

MS = PRODUCTION MILESTONE, LF = LATE FINISH, D = DEFAULT, A = AGREEMENT SHIP DATE, C = COMPLETE, PM = OWNER'S DECISION REQUIRED

Project Thunder Preliminary Production Schedule
ADMINISTRATION AND ENGINEERING

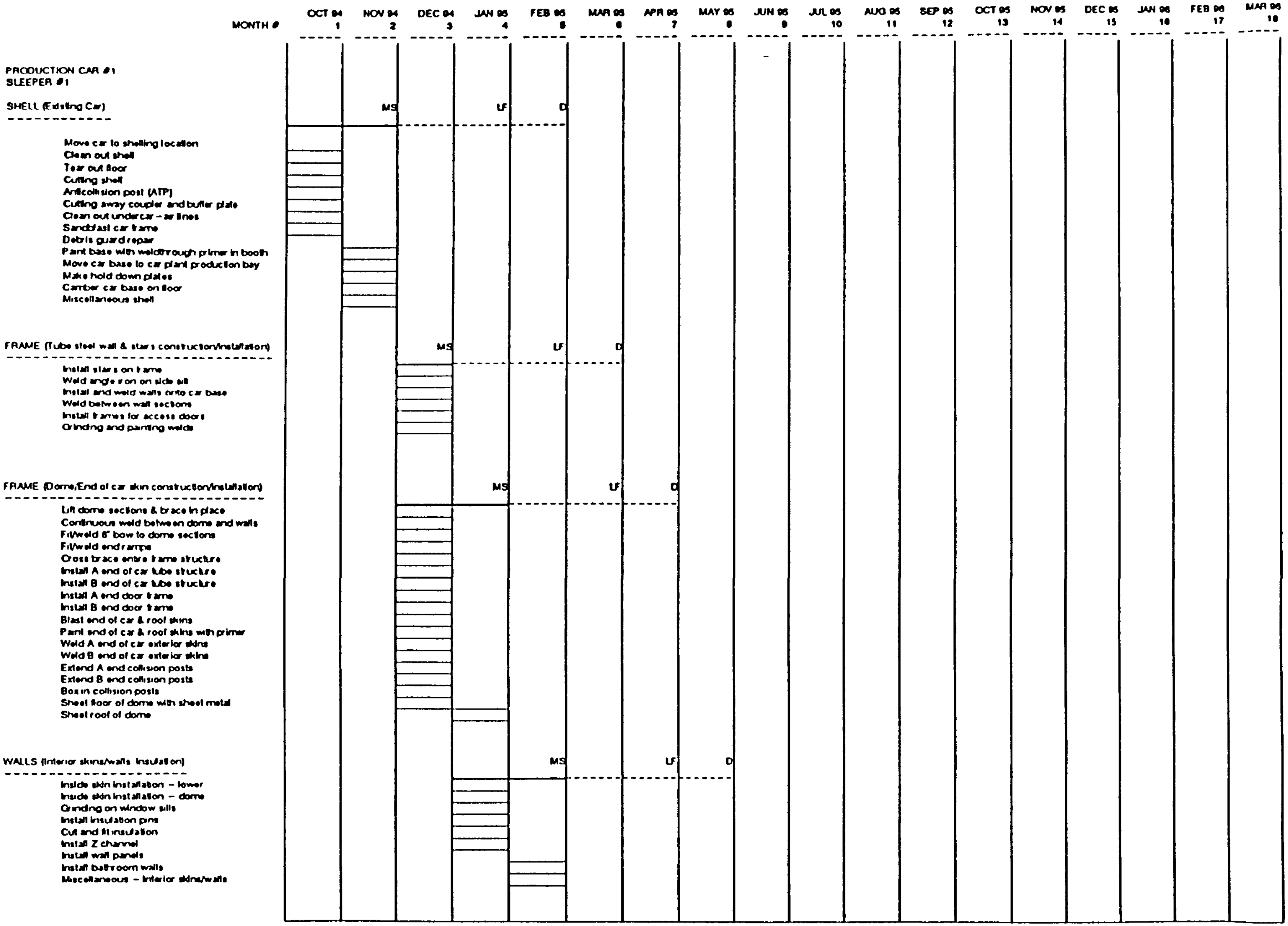
Event / Month	Oct-94 1	Nov-94 2	Dec 94 3	Jan-95 4	Feb-95 5	Mar-95 6	Apr 95 7	May-95 8	Jun-95 9	Jul-95 10	Aug-95 11	Sep 95 12	Oct-95 13	Nov-95 14	Dec 95 15	Jan 96 16	Feb-96 17	Mar 96 18
ENGINEERING (Continued)																		
Dining Cars (Railcar #s 15 & 16) Engineering					MS													
General Arrangements	C																	
Dining Room Layout		PM																
Kitchen Layout		PM																
Kitchen Specifications			PM															
PM Review & Approval			PM															
RRC Design Modifications																		
PM Final Approval			PM															
Dining Room Interior Design					PM													
Detailed Wait Stations Designs			PM															
Detailed Kitchen Drawings			PM															
Library/Lounge Interior Design																		
PM Review & Approval					PM													
Structural Design & Analysis																		
Preliminary Structure		C																
Final Design		MS																
Car Systems																		
HVAC																		
Water																		
Sewage																		
Electrical																		
Lounge Car #1 (Railcar # 17) Engineering					MS													
General Arrangements																		
RRC Design	C																	
PM Review & Approval Upper and Lower Level			PM															
RRC Design Modifications																		
PM Final Approval			PM															
Structural Design & Analysis																		
Preliminary Structure		C																
Final Design		MS																
Lounge Car #1 Systems																		
HVAC																		
Water																		
Sewage																		
Electrical																		
Lounge Car #1 Interior																		
Upper and Lower Level Designs																		
PM Office Layout																		
General Store Layout																		
PM Review & Approval			PM															
Final Designs																		
Bar					PM													
Office					PM													
Furnishings																		
Fabrics																		
Hardware																		
PM Review & Approval					PM													
Lounge Car #2 (Railcar # 18) Engineering					MS													
General Arrangements																		
RRC Design	C																	
PM Review & Approval Upper and Lower Level			PM															
RRC Design Modifications																		
PM Final Approval			PM															

MS = PRODUCTION MILESTONE, LF = LATE FINISH, D= DEFAULT, A = AGREEMENT SHIP DATE, C = COMPLETED PM = OWNER'S DECISION REQUIRED

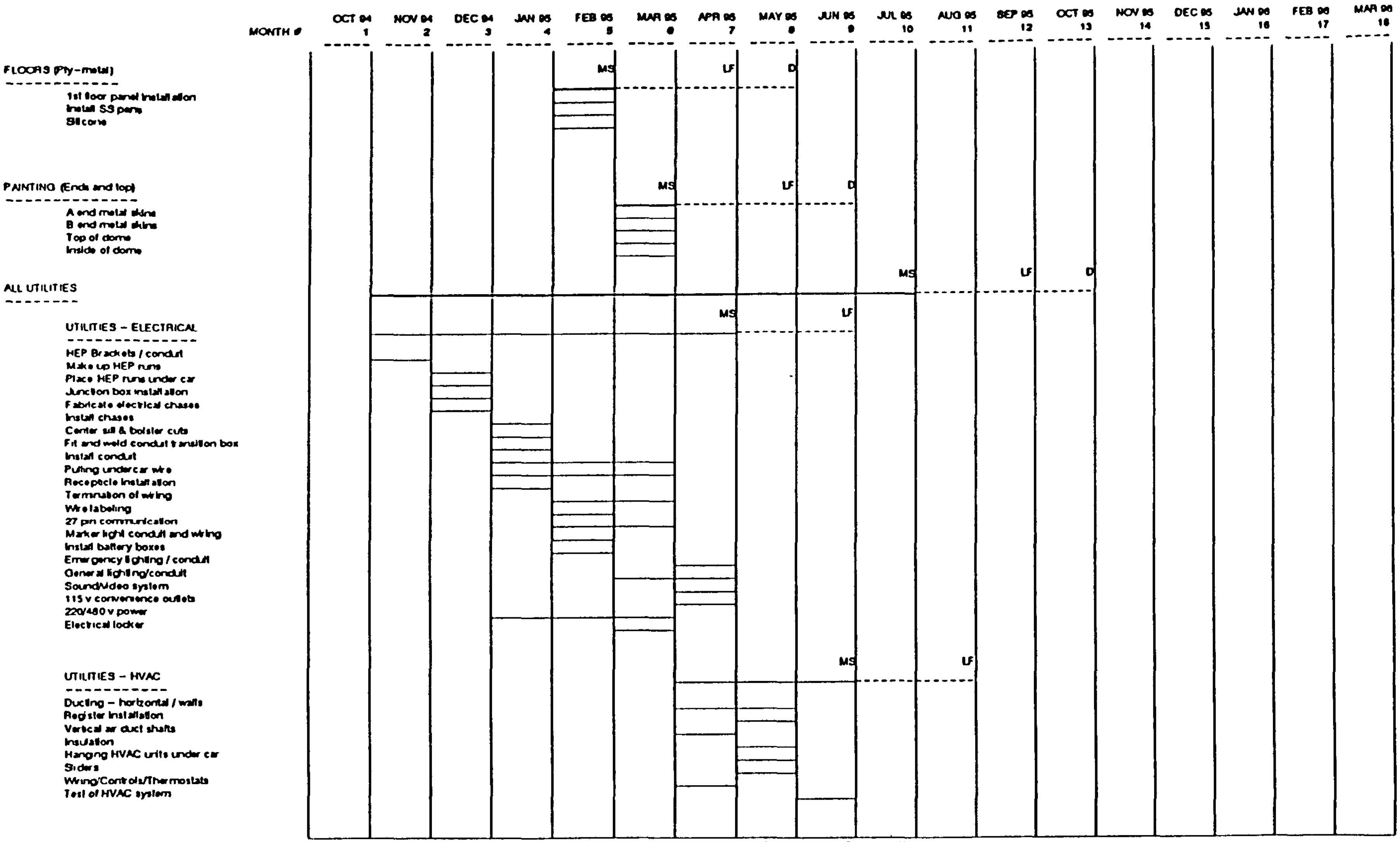
Project Thunder Prel[illegible]ary Production Schedule
ADMINISTRATION AND ENGINEERING

Event / Month	Oct-94 1	Nov-94 2	Dec 94 3	Jan-95 4	Feb-95 5	Mar-95 6	Apr 95 7	May 95 8	Jun-95 9	Jul-95 10	Aug-95 11	Sep-95 12	Oct-95 13	Nov 95 14	Dec 95 15	Jan-96 16	Feb-96 17	Mar 96 18	
ENGINEERING (Continued)																			
Lounge Car #2 (Railcar # 18) Engineering (Continued)																			
Structural Design & Analysis																			
Preliminary Structure	C																		
Final Design	MS																		
Lounge Car #2 Systems																			
HVAC																			
Water																			
Sewage																			
Electrical																			
Lounge Car #2 (Railcar #18) Interior																			
Upper and Lower Level Designs																			
General Lounge Area Layout																			
Video and Multi Media Layout																			
PM Review & Approval			PM																
Final Designs																			
Upper Level Lounge																			
Lower Level Video and Multi Media Details																			
Furnishings																			
Fabrics																			
Hardware																			
PM Review & Approval					PM														
Lounge Car #3 (Railcar # 19) Engineering					MS														
General Arrangements																			
RRC Design	C																		
PM Review & Approval Upper and Lower Level				PM															
RRC Design Modifications																			
PM Final Approval				PM															
Structural Design & Analysis																			
Preliminary Structure	C																		
Final Design	MS																		
Lounge Car #3 Systems																			
HVAC																			
Water																			
Sewage																			
Electrical																			
Lounge Car #3 (Railcar #19) Interior																			
Upper Level Seating and Sound Sysytem Designs																			
Lower Level Long Branch Saloon Design																			
PM Review & Approval				PM															
Final Designs																			
Upper Level Designs																			
Long Branch Saloon Design Details																			
Furnishings																			
Fabrics																			
Hardware																			
PM Review & Approval					PM														

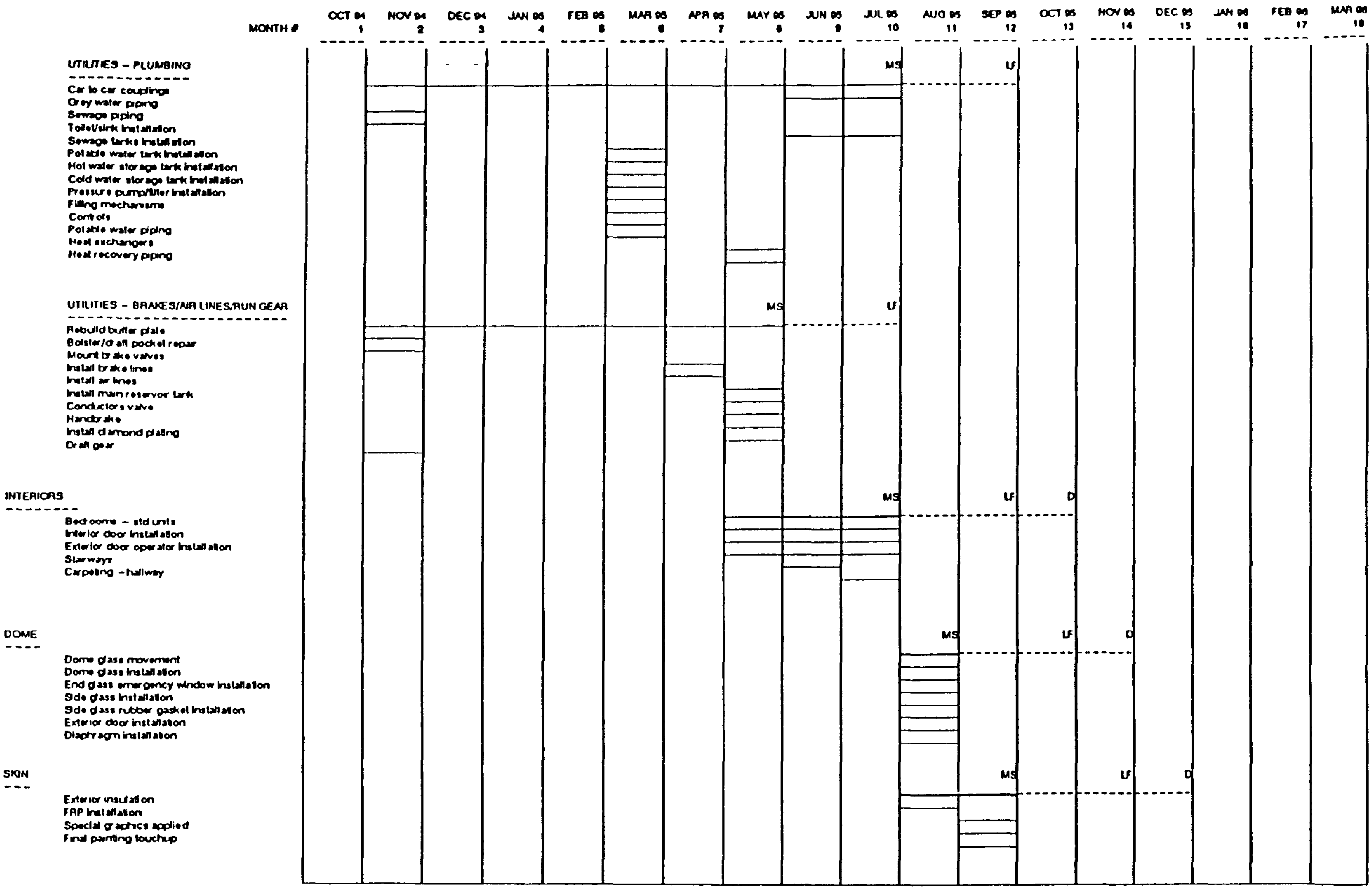
Event / Month	Oct-94 1	Nov-94 2	Dec 94 3	Jan-95 4	Feb-95 5	Mar-95 6	Apr 95 7	May-95 8	Jun-95 9	Jul-95 10	Aug-95 11	Sep-95 12	Oct-95 13	Nov-95 14	Dec 95 15	Jan-96 16	Feb-96 17	Mar 96 18
ENGINEERING (Continued)																		
Spa Car (Railcar # 20) Engineering					MS													
General Arrangements																		
RRC Design	C																	
PM Review & Approval			PM															
RRC Design Modifications																		
PM Final Approval			PM															
Structural Design & Analysis																		
Preliminary Structure	C																	
Final Design	MS																	
Spa Car Systems																		
HVAC																		
Water																		
Sewage																		
Electrical																		
Spa Car (Railcar # 20) Interior																		
Final Designs																		
HotTubs Designs																		
Arrangements																		
Water Quality Maintenance																		
Massage Rooms																		
Open Platform																		
Furnishings																		
Fabrics																		
Hardware																		
PM Review & Approval					PM													
Staff Cars (3) Engineering						MS												
General Arrangements																		
RRC Design	C																	
RRC Design Modifications																		
PM Final Approval					PM													
Structural Design & Analysis																		
Minor Modifications																		
Staff Cars Systems																		
HVAC																		
Water																		
Sewage																		
Electrical																		
Staff Cars Interior-Final Design						PM												



SLEEPER CAR #1



SLEEPER CAR #1



SLEEPER CAR #1

TEST	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
												MS		LF	A D			
Amtrak inspection																		
UP inspection																		
Move car out of shop																		
Final systems testing																		
"White glove" cleaning																		
Apply plastics covers, runners																		
Deliver car, hours contingency																		

PRODUCTION MILESTONES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PER PERIOD																		
Plan	0	1	1	1	2	1	1	1	1	3	1	2	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	1	2	3	5	6	7	8	9	12	13	15	15	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

LATE FINISHES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PER PERIOD																		
Plan	0	0	0	1	1	1	2	1	1	1	1	3	1	2	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	1	2	3	5	6	7	8	9	12	13	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

DEFAULTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PER PERIOD																		
Plan	0	0	0	0	1	1	1	2	1	0	0	0	2	1	2	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	1	2	3	5	6	6	6	6	8	9	11	11	11	11
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

SLEEPER CAR #1

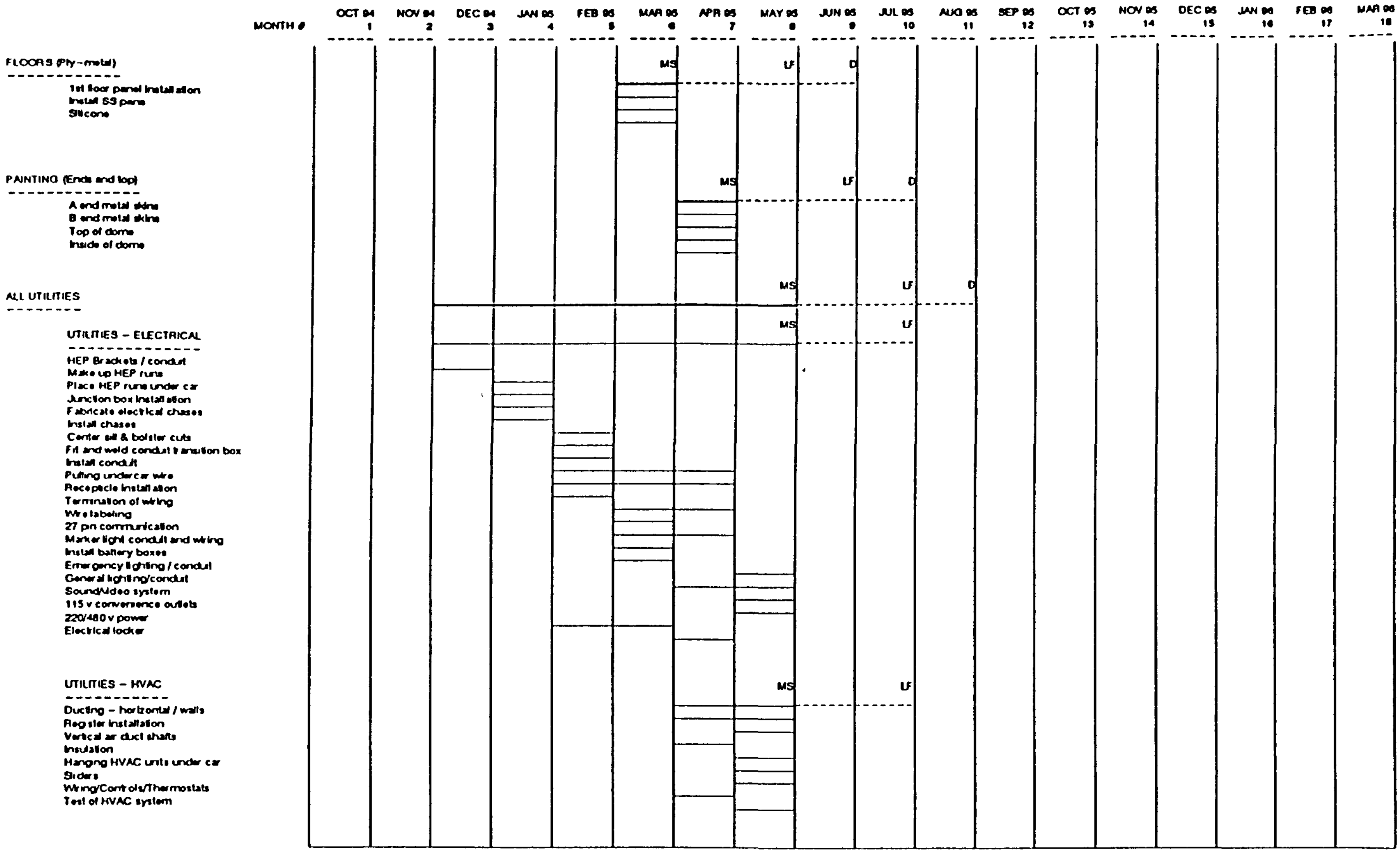
TEST	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
												MS		LF	A D			
Amtrak inspection																		
UP inspection																		
Move car out of shop																		
Final systems testing																		
"White glove" cleaning																		
Apply plastics, covers, runners																		
Deliver car, hours contingency																		

PRODUCTION MILESTONES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PER PERIOD																		
Plan	0	1	1	1	2	1	1	1	1	3	1	2	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	1	2	3	5	6	7	8	9	12	13	15	15	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

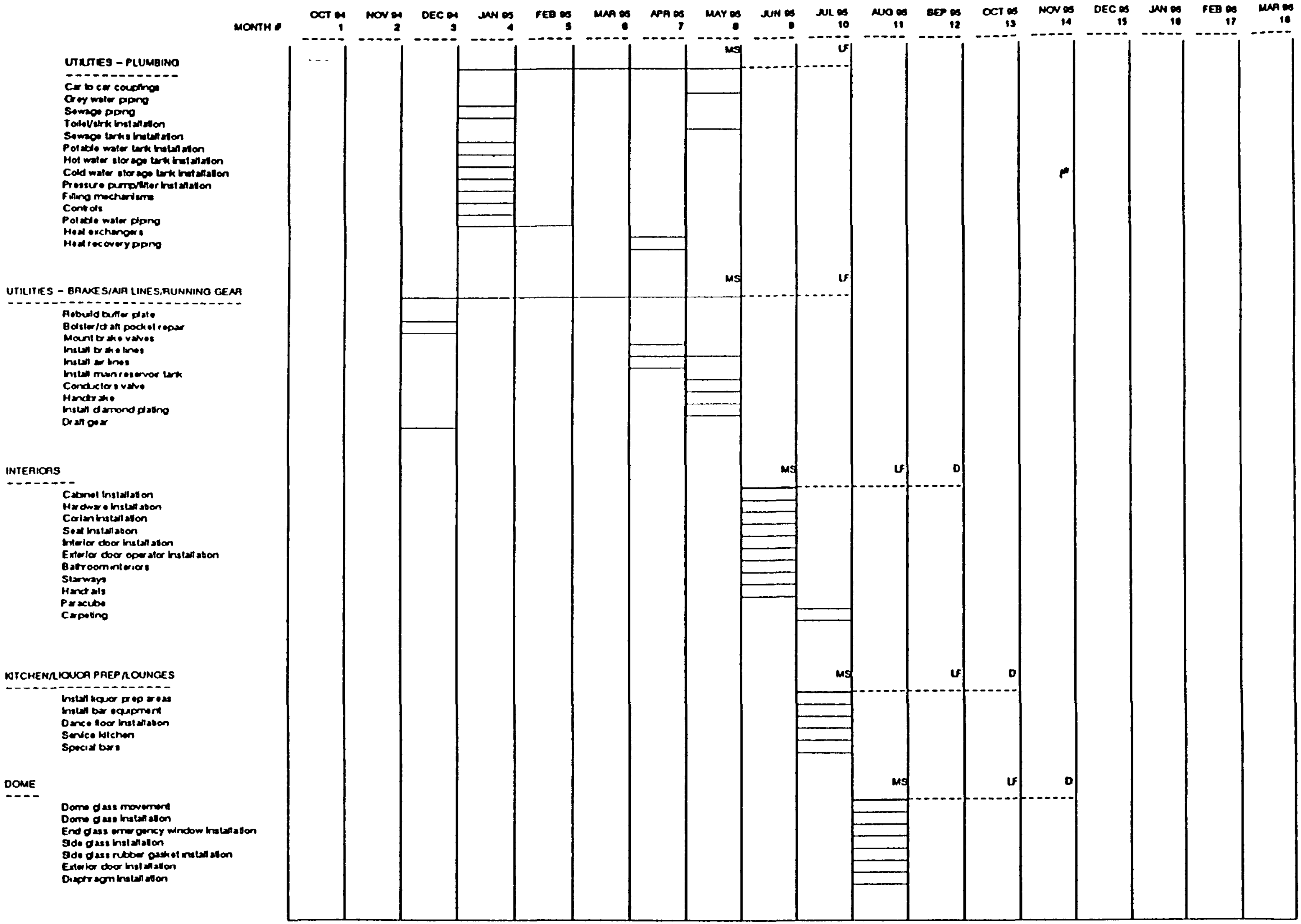
LATE FINISHES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PER PERIOD																		
Plan	0	0	0	1	1	1	2	1	1	1	1	3	1	2	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	1	2	3	5	6	7	8	9	12	13	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

DEFAULTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PER PERIOD																		
Plan	0	0	0	0	1	1	1	2	1	0	0	0	2	1	2	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	1	2	3	5	6	6	6	6	8	9	11	11	11	11
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

SLEEPER CAR #1



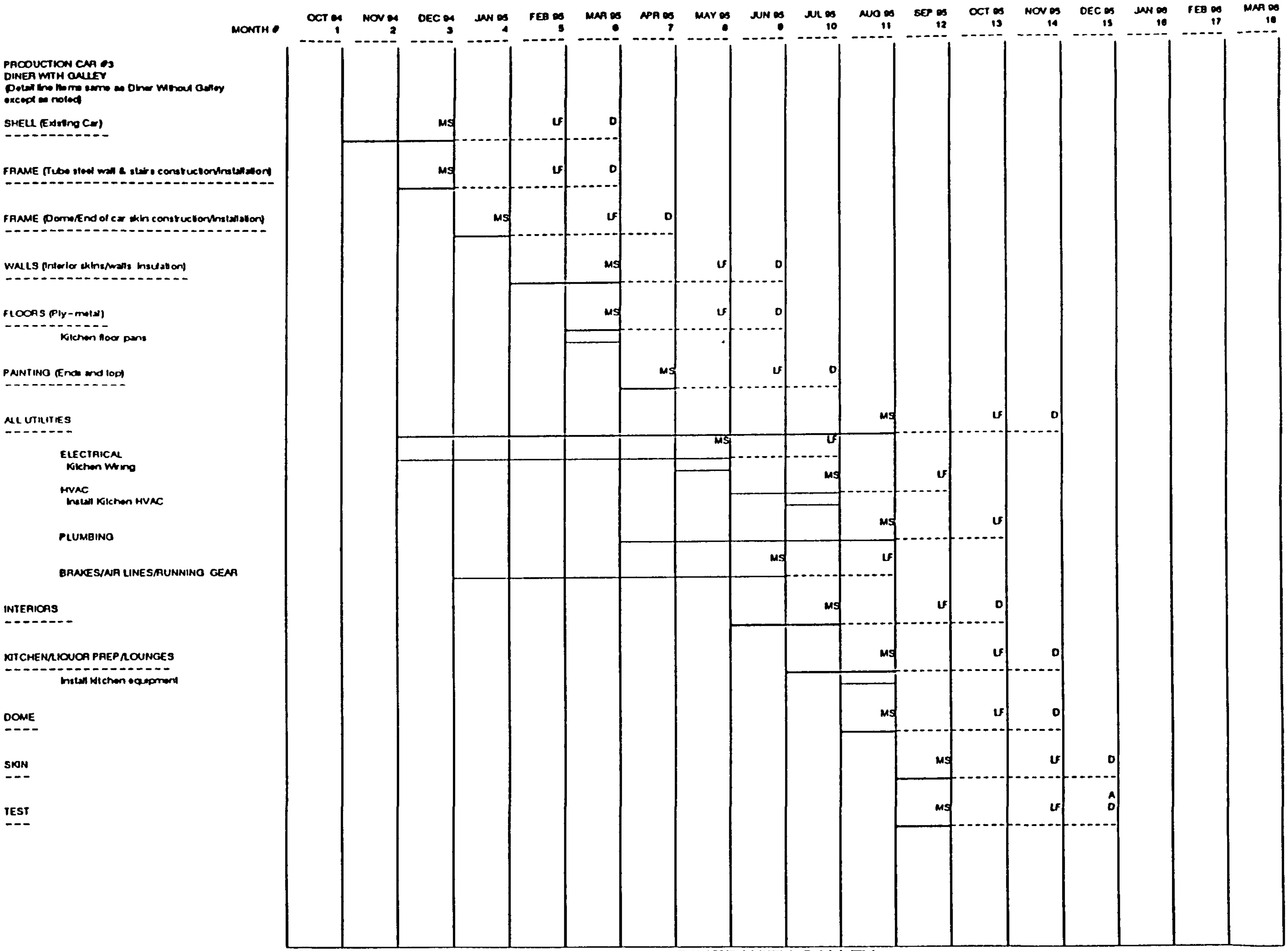
DINER WITHOUT GALLEY



DINER WITHOUT GALLEY

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
SKIN											MS		LF	D				
Exterior insulation																		
FRP installation																		
Special graphics applied																		
Final painting touchup																		
TEST											MS		LF	D				
Amtrak inspection																		
UP inspection																		
Move car out of shop																		
Final systems testing																		
"White glove" cleaning																		
Apply plastics covers runners																		
Deliver car hours contingency																		
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	2	1	0	2	1	5	1	1	3	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	2	3	3	5	6	11	12	13	16	16	16	16	16	16	16	16
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	2	1	0	2	1	5	1	1	3	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	2	3	3	5	6	11	12	13	16	16	16	16	16	16
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	2	1	0	2	1	1	1	1	3	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	2	3	3	5	6	7	8	9	12	12	12	12	12
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

DINER WITHOUT GALLEY



DINER WITH GALLEY

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	2	1	0	2	1	1	1	2	4	2	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	2	3	3	5	6	7	8	10	14	16	16	16	16	16	16	16
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	2	1	0	2	1	1	1	2	4	2	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	2	3	3	5	6	7	8	10	14	16	16	16	16	16
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	2	1	0	2	1	0	0	1	3	2	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	2	3	3	5	6	6	6	7	10	12	12	12	12
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

DINER WITH GALLEY

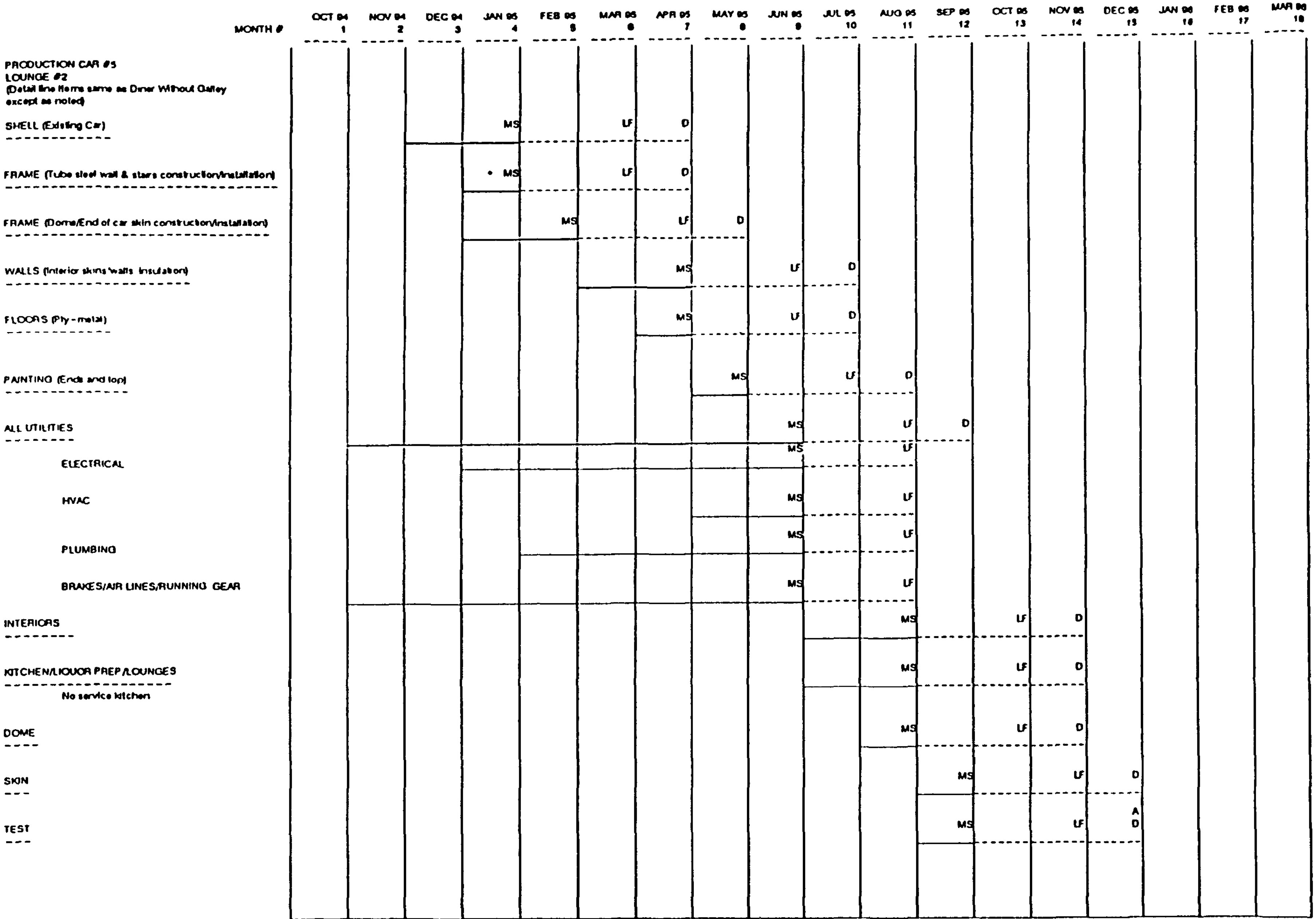
	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PRODUCTION CAR #4 LOUNGE #1 (Detail line items same as Diner Without Galley except as noted)																		
SHELL (Existing Car)				MS		LF	D											
FRAME (Tube steel wall & stairs construction/installation)				MS		LF	D											
FRAME (Dome/End of car skin construction/installation)					MS		LF	D										
WALLS (Interior skins/walls insulation)							MS		LF	D								
FLOORS (Ply-metal)							MS		LF	D								
PAINTING (Ends and top)								MS		LF	D							
ALL UTILITIES									MS		LF	D						
ELECTRICAL									MS		LF							
HVAC									MS		LF							
PLUMBING									MS		LF							
BRAKES/AIR LINES/RUNNING GEAR									MS		LF							
INTERIORS											MS		LF	D				
KITCHEN/LIQUOR PREP/LOUNGES No service kitchen											MS		LF	D				
DOME											MS		LF	D				
SKIN												MS		LF	D			
TEST												MS		LF	A D			

LOUNGE CAR #1 (GENERAL STORE)

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9
PRODUCTION MILESTONES									
PER PERIOD									
Plan	0	0	0	2	1	0	2	1	5
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE									
Plan	0	0	0	2	3	3	5	6	11
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES									
PER PERIOD									
Plan	0	0	0	0	0	2	1	0	2
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE									
Plan	0	0	0	0	0	2	3	3	5
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS									
PER PERIOD									
Plan	0	0	0	0	0	0	2	1	0
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE									
Plan	0	0	0	0	0	0	2	3	3
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%

MONTH #	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES									
PER PERIOD									
Plan	0	3	2	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE									
Plan	11	14	16	16	16	16	16	16	16
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES									
PER PERIOD									
Plan	1	5	0	3	2	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE									
Plan	6	11	11	14	16	16	16	16	16
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS									
PER PERIOD									
Plan	2	1	1	0	3	2	0	0	0
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE									
Plan	5	6	7	7	10	12	12	12	12
Complete	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%

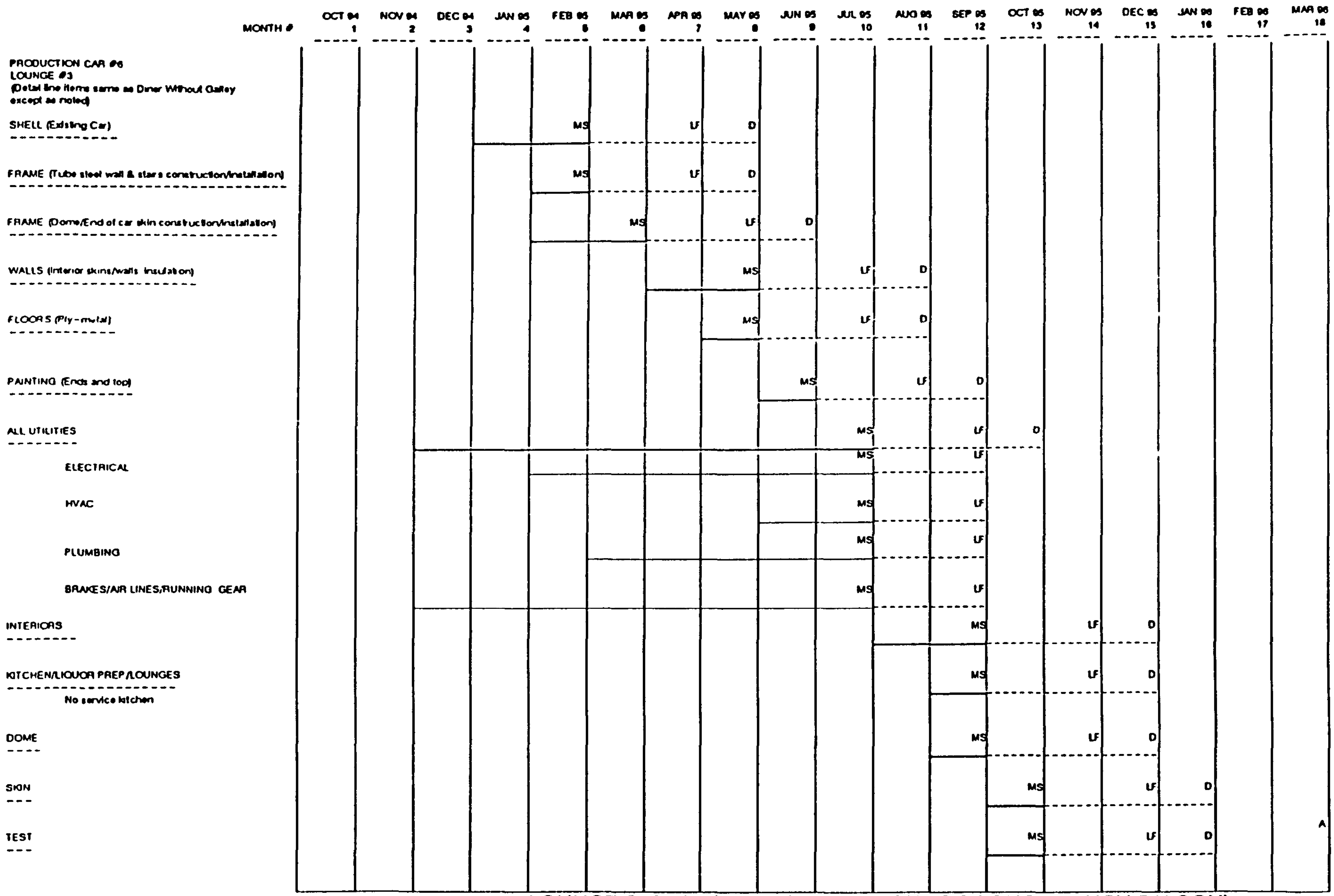
LOUNGE CAR #1 (GENERAL STORE)



LOUNGE CAR #2 (VIDEO GAMES/MULTIMEDIA/PLATFORM)

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	2	1	0	2	1	5	0	3	2	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	2	3	3	5	6	11	11	14	16	16	16	16	16	16	16
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	2	1	0	2	1	5	0	3	2	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	2	3	3	5	6	11	11	14	16	16	16	16	16
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	0	2	1	0	2	1	1	0	3	2	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	2	3	3	5	6	7	7	10	12	12	12	12
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

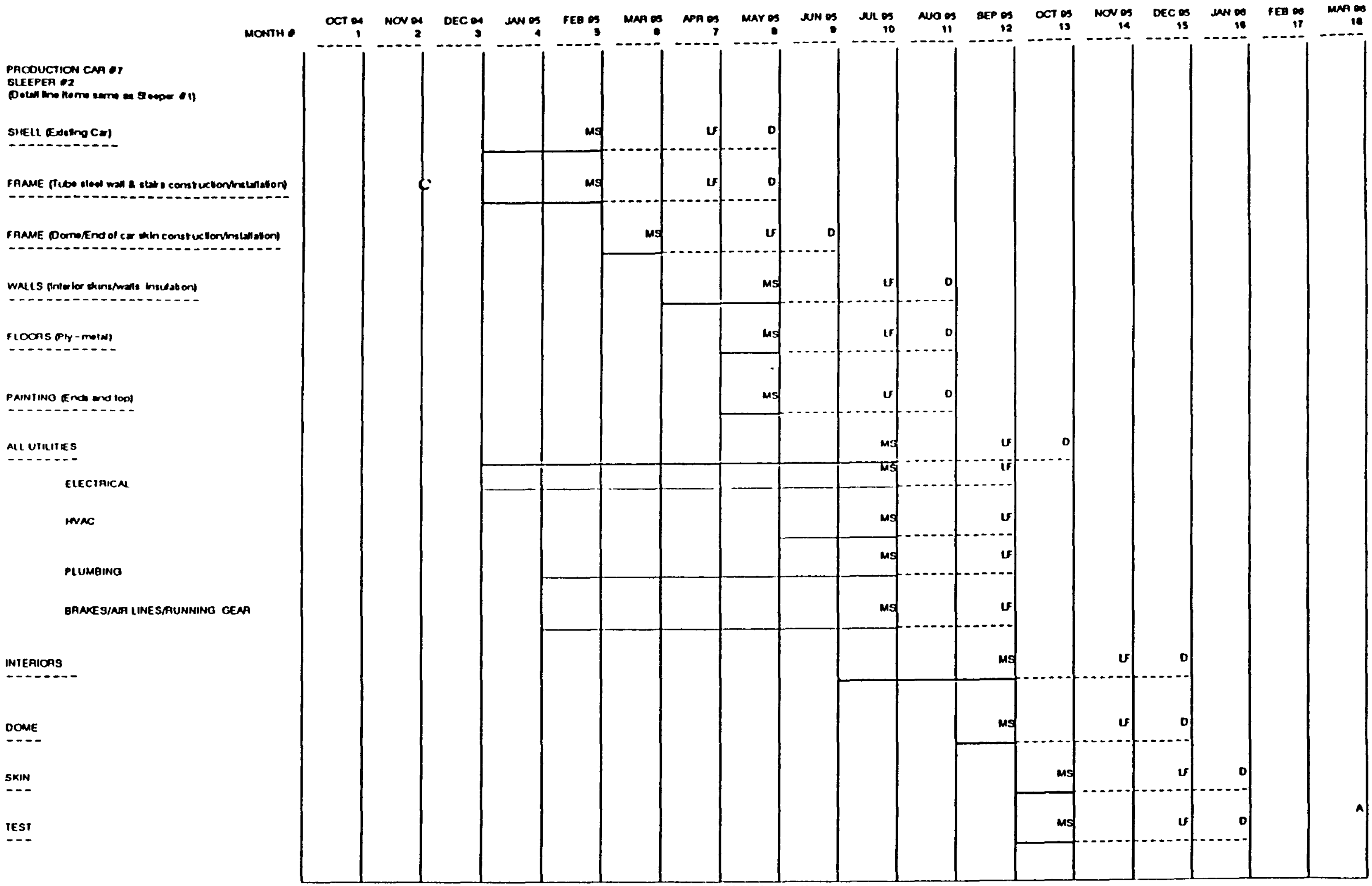
LOUNGE CAR #2 (VIDEO GAMES/MULTIMEDIA/PLATFORM)



LOUNGE CAR #3 (DISCO/DENIMS LOUNGE, LONG BRANCH SALOON)

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	0	2	1	0	2	1	5	0	3	2	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	2	3	3	5	6	11	11	14	16	16	16	16	16	16
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	2	1	0	2	1	5	0	3	2	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	2	3	3	5	6	11	11	14	16	16	16	16
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	2	1	0	2	1	1	0	3	2	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	2	3	3	5	6	7	7	10	12	12	12
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

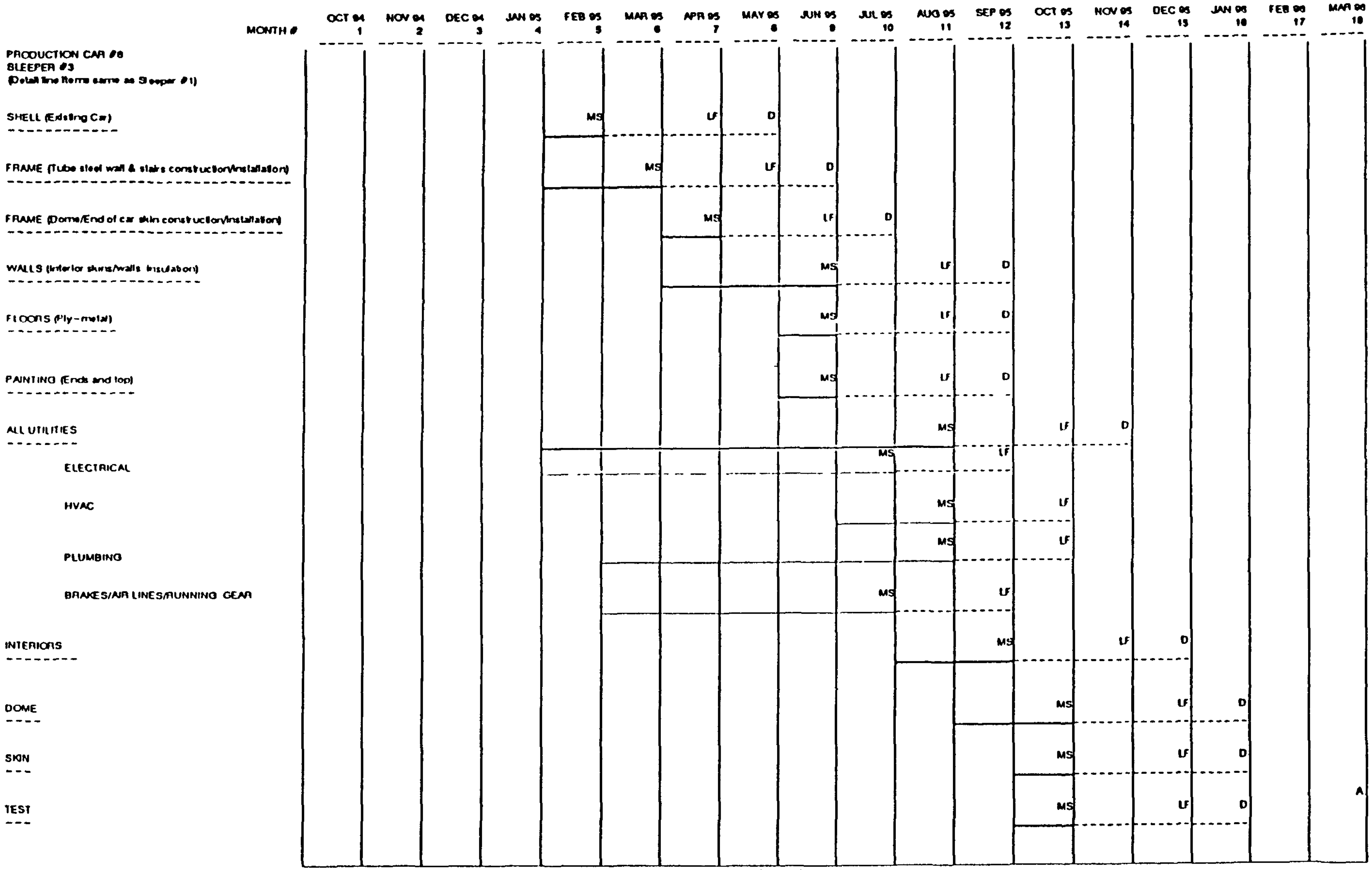
LOUNGE CAR #3 (DISCO/DENIMS LOUNGE, LONG BRANCH SALOON)


MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PRODUCTION CAR #7
SLEEPER #2
(Detail line items same as Sleeper #1)
SHELL (Existing Car)
FRAME (Tube steel wall & stairs construction/installation)
FRAME (Dome/End of car skin construction/installation)
WALLS (Interior skins/walls insulation)
FLOORS (Ply-metal)
PAINTING (Ends and top)
ALL UTILITIES
ELECTRICAL
HVAC
PLUMBING
BRAKES/AIR LINES/RUNNING GEAR
INTERIORS
DOME
SKIN
TEST
MS
LF
D
C
A

SLEEPER #2

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	0	2	1	0	3	0	5	0	2	2	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	2	3	3	6	6	11	11	13	15	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	2	1	0	3	0	5	0	2	2	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	2	3	3	6	6	11	11	13	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	2	1	0	3	0	1	0	2	2	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	2	3	3	6	6	7	7	9	11	11	11
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

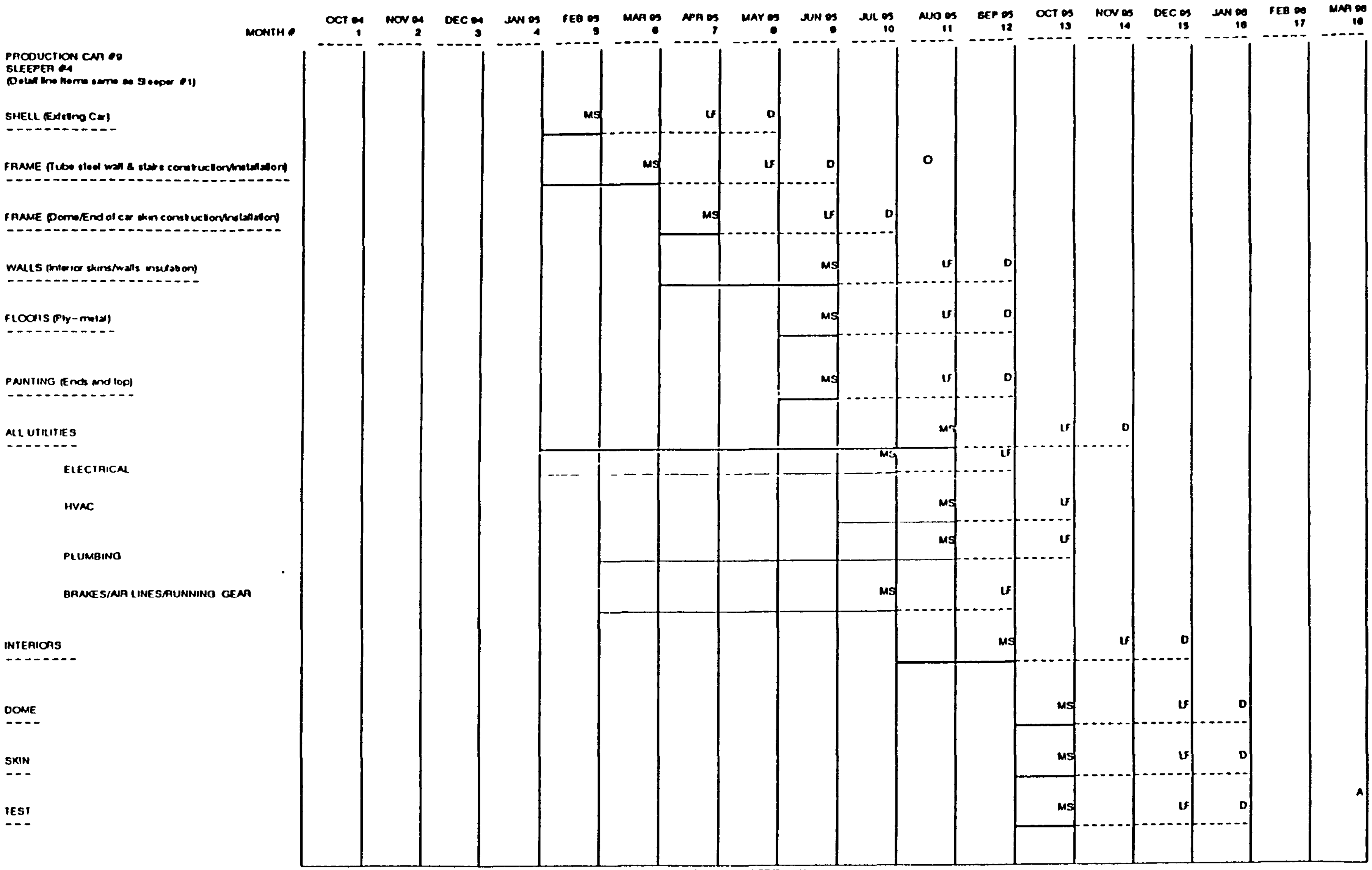
SLEEPER #2


MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PRODUCTION CAR #8
SLEEPER #3
(Detail line items same as Sleeper #1)
SHELL (Existing Car)
FRAME (Tube steel wall & stairs construction/installation)
FRAME (Dome/End of car skin construction/installation)
WALLS (Interior skins/walls insulation)
FLOORS (Ply-metal)
PAINTING (Ends and top)
ALL UTILITIES
ELECTRICAL
HVAC
PLUMBING
BRAKES/AIR LINES/RUNNING GEAR
INTERIORS
DOME
SKIN
TEST

SLEEPER #3

MONTH #	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	1	2	3	3	6	8	11	12	15	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	1	2	3	3	6	8	11	12	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	1	1	1	0	3	0	1	1	3	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	1	2	3	3	6	6	7	8	11	11	11
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

SLEEPER #3

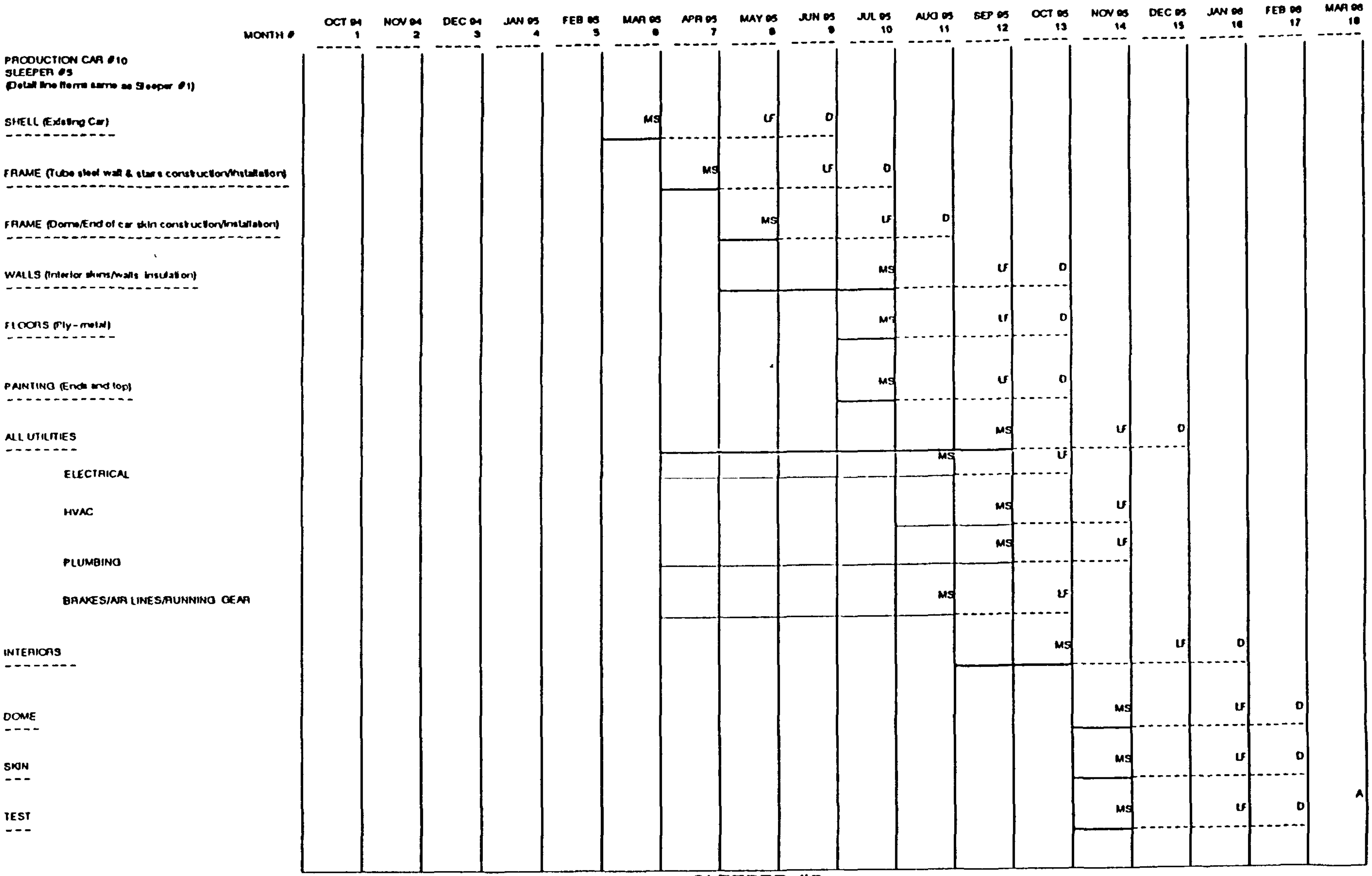


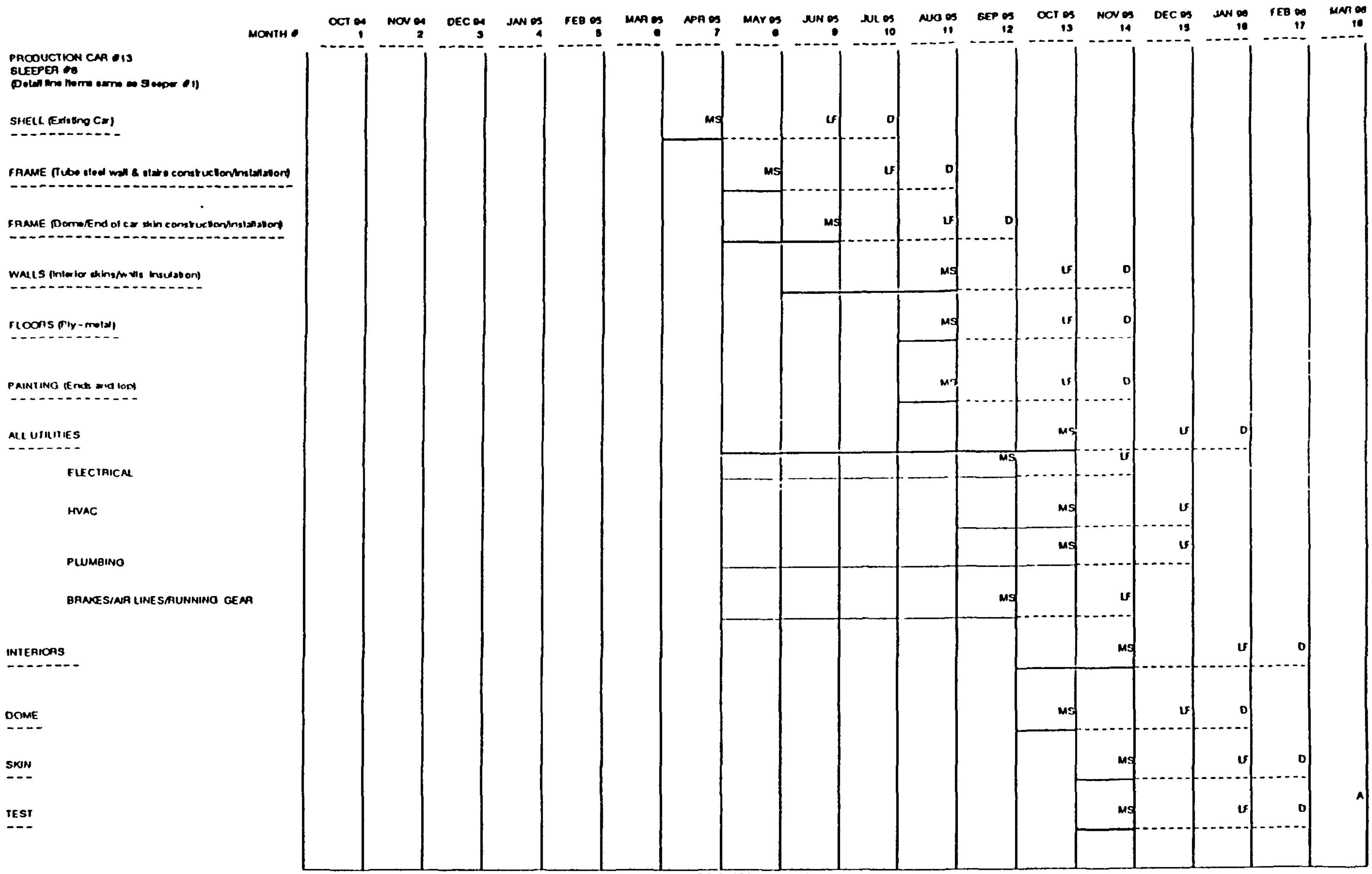
MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PRODUCTION CAR #9
SLEEPER #4
(Detail line items same as Sleeper #1)
SHELL (Existing Car)
FRAME (Tube steel wall & stairs construction/installation)
FRAME (Dome/End of car skin construction/installation)
WALLS (Interior skins/walls insulation)
FLOORS (Ply-metal)
PAINTING (Ends and top)
ALL UTILITIES
ELECTRICAL
HVAC
PLUMBING
BRAKES/AIR LINES/RUNNING GEAR
INTERIORS
DOME
SKIN
TEST
MS
LF
D
O
A

SLEEPER #4

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	1	2	3	3	6	8	11	12	15	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	1	2	3	3	6	8	11	12	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	1	1	1	0	3	0	1	1	3	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	1	2	3	3	6	6	7	8	11	11	11
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

SLEEPER #4


MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PRODUCTION CAR #10
SLEEPER #5
(Detail line items same as Sleeper #1)
SHELL (Existing Car)
FRAME (Tube steel wall & stairs construction/installation)
FRAME (Dome/End of car skin construction/installation)
WALLS (Interior skins/walls insulation)
FLOORS (Ply-metal)
PAINTING (Ends and top)
ALL UTILITIES
ELECTRICAL
HVAC
PLUMBING
BRAKES/AIR LINES/RUNNING GEAR
INTERIORS
DOME
SKIN
TEST
MS
LF
D
A
SLEEPER #5


MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PRODUCTION CAR #13
SLEEPER #8
(Detail line items same as Sleeper #1)
SHELL (Existing Car)
FRAME (Tube steel wall & stairs construction/installation)
FRAME (Dome/End of car skin construction/installation)
WALLS (Interior skins/walls insulation)
FLOORS (Ply-metal)
PAINTING (Ends and top)
ALL UTILITIES
ELECTRICAL
HVAC
PLUMBING
BRAKES/AIR LINES/RUNNING GEAR
INTERIORS
DOME
SKIN
TEST
MS
LF
D
A

SLEEPER #8

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	1	1	1	0	3	2	4	3	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	1	2	3	3	6	8	12	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	0	1	1	1	0	3	2	4	3	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	0	1	2	3	3	6	8	12	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	0	0	1	1	1	0	3	0	2	3	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	0	0	1	2	3	3	6	6	8	11	11
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

SLEEPER #8

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

UTILITIES – TRUCKSHOP MILESTONES

Production detail

Tear Down Trucks (Disassemble)

- Remove trucks from car
- Tear down trucks
- Sandblast truck frames springs parts
- Non destructive test trucks
- Check truck frames for tram
- Straightening truck pedistal legs
- Grind and ream holes in legs
- Test springs
- Inspect parts
- Inspect equalizers
- Welding truck frame
- Welding wear plates
- Paint truck frames
- Paint truck parts

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
Tear down in month – milestone	0	3	3	3	3	3	3	3	3	3	2	3	2	2	0	0	0	0
Total disassembled – milestone	NA	3	6	9	12	15	18	21	24	27	29	32	34	36	36	36	36	36
Total disassembled – late finish	NA	0 – 2	0 – 5	0 – 8	0 – 11	4 – 14	7 – 17	10 – 20	13 – 23	16 – 26	19 – 28	28 – 31	25 – 33	27 – 35	30 – 35	33 – 35	35	36
Total disassembled – default	NA	NA	NA	NA	NA	< 3	< 6	< 9	< 12	< 15	< 18	< 21	< 24	< 27	< 30	< 33	< 35	< 36

Reassemble

- Trucks reassembled to put under car

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
Reassembled in month – milestone	0	0	0	4	4	3	4	4	3	3	3	3	3	2	0	0	0	0
Total reassembled – milestone	0	0	0	4	8	11	15	19	22	25	28	31	34	36	36	36	36	36
Total reassembled – late finish	NA	NA	NA	NA	0 – 7	0 – 10	0 – 14	9 – 18	12 – 21	15 – 24	18 – 27	22 – 30	25 – 33	27 – 35	30 – 35	33 – 35	35	36
Total reassembled – default	NA	NA	NA	NA	NA	NA	NA	< 8	< 12	< 15	< 18	< 21	< 24	< 27	< 30	< 33	< 35	< 36

Put Under Car

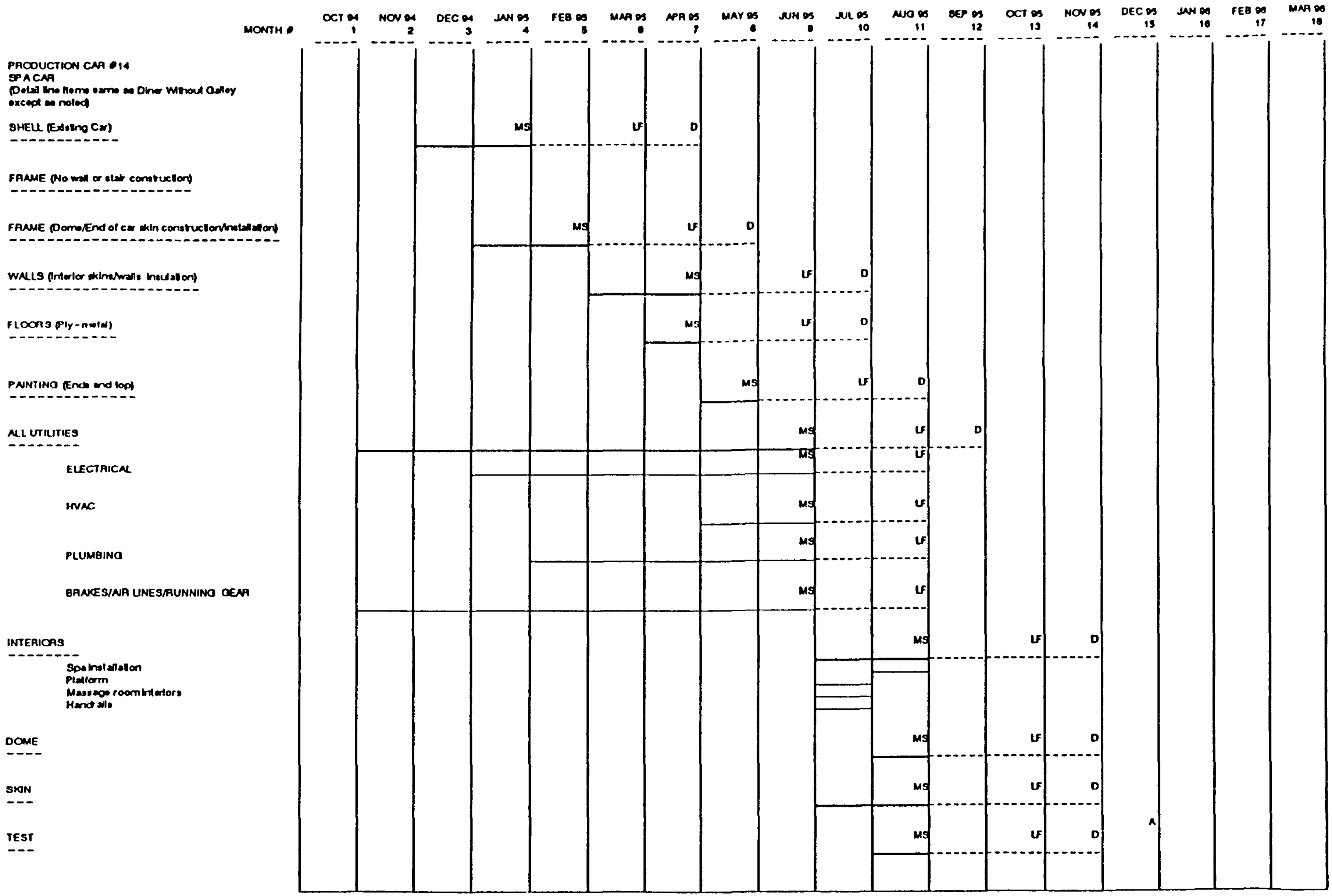
- Brake assembly off car
- Off car work on buffers draft gear couplers
- Place trucks under car connect
- Single car testing

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
Put under car in month	0	0	0	0	0	0	2	0	0	0	2	12	6	4	10	0	0	0
Total put under car – milestone	0	0	0	0	0	0	2	2	2	2	4	16	22	26	36	36	36	36
Total put under car – late finish	NA	NA	NA	NA	NA	NA	0 – 1	0 – 1	0 – 1	0 – 1	0 – 3	0 – 15	0 – 21	0 – 25	5 – 35	16 – 35	35	35
Total put under car – default	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	< 4	< 15	< 25	< 35

TRUCK SHOP

MONTH #	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	1	2	4	6	8	11	14	17	20	23	26	29	32	35	38	41	44
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	1	1	1	2	2	3	3	3	3	3	3	3	3	3	3	3	3
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	1	2	3	5	7	10	13	16	19	22	25	28	31	34	37	40	43
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	1	1	2	2	2	2	2	2	2	3	3	3	3
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	1	2	4	6	8	10	12	14	16	19	22	25	28
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

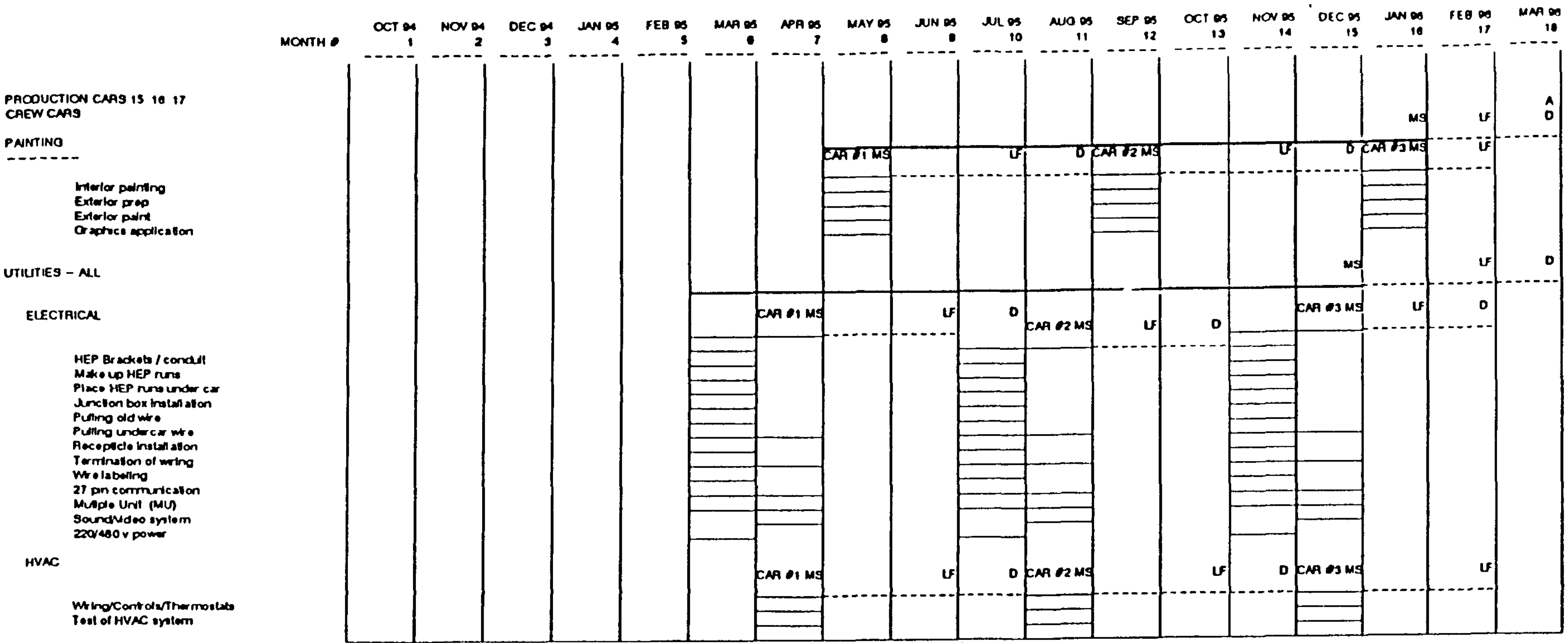
TRUCK SHOP


MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PRODUCTION CAR #14
SPA CAR
(Detail line items same as Diner Without Galley except as noted)
SHELL (Existing Car)
FRAME (No wall or stair construction)
FRAME (Dome/End of car skin construction/installation)
WALLS (Interior skins/walls insulation)
FLOORS (Ply-metal)
PAINTING (Ends and top)
ALL UTILITIES
ELECTRICAL
HVAC
PLUMBING
BRAKES/AIR LINES/RUNNING GEAR
INTERIORS
Spa installation
Platform
Massage room interiors
Handrails
DOME
SKIN
TEST
MS
LF
D
A

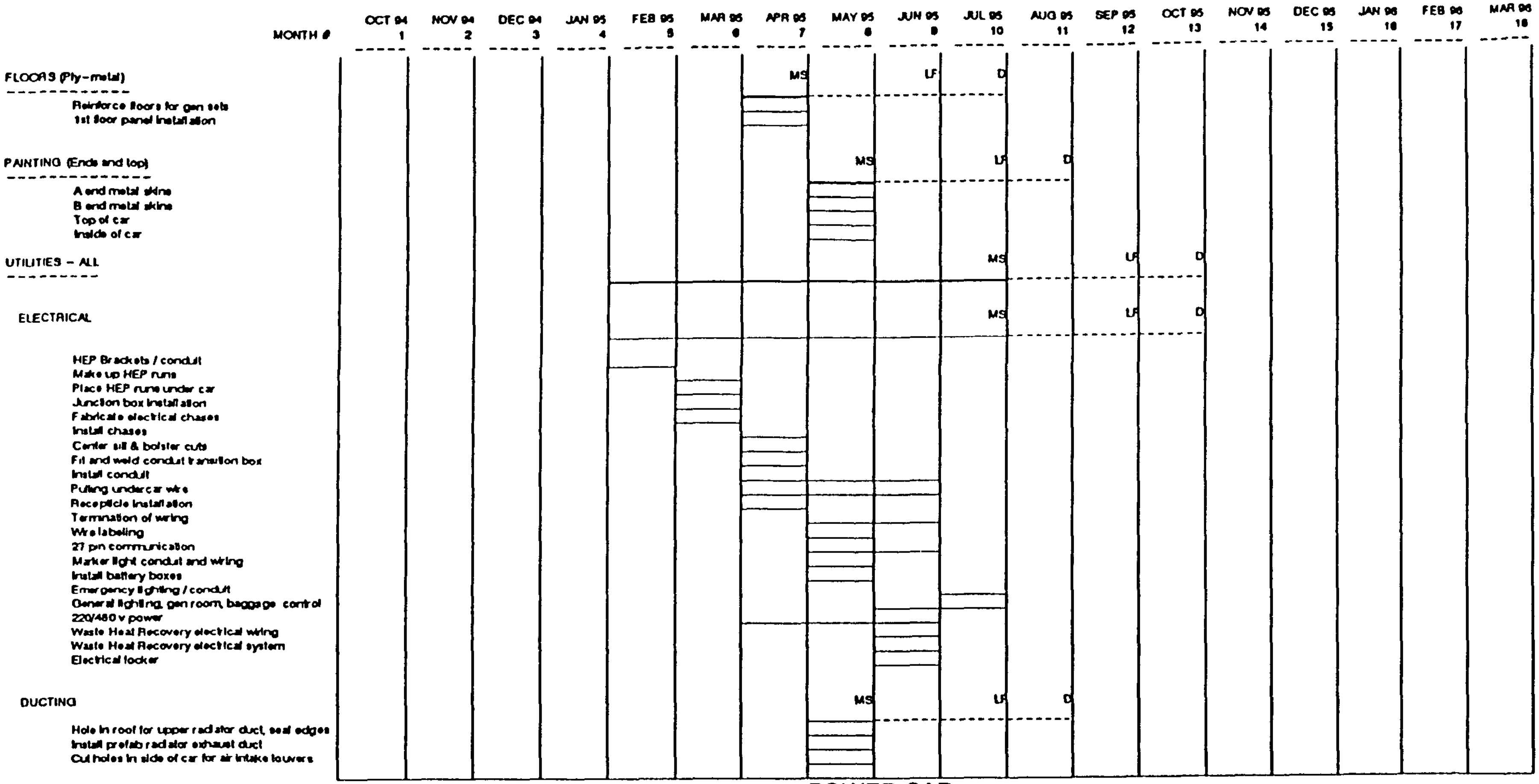
SPA CAR

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	1	1	0	2	1	5	4	0	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	1	2	2	4	5	10	14	14	14	14	14	14	14	14	14
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	1	1	0	2	1	5	0	4	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	1	2	2	4	5	10	10	14	14	14	14	14	14
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	0	1	1	0	2	1	1	0	4	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	1	2	2	4	5	6	6	10	10	10	10	10
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

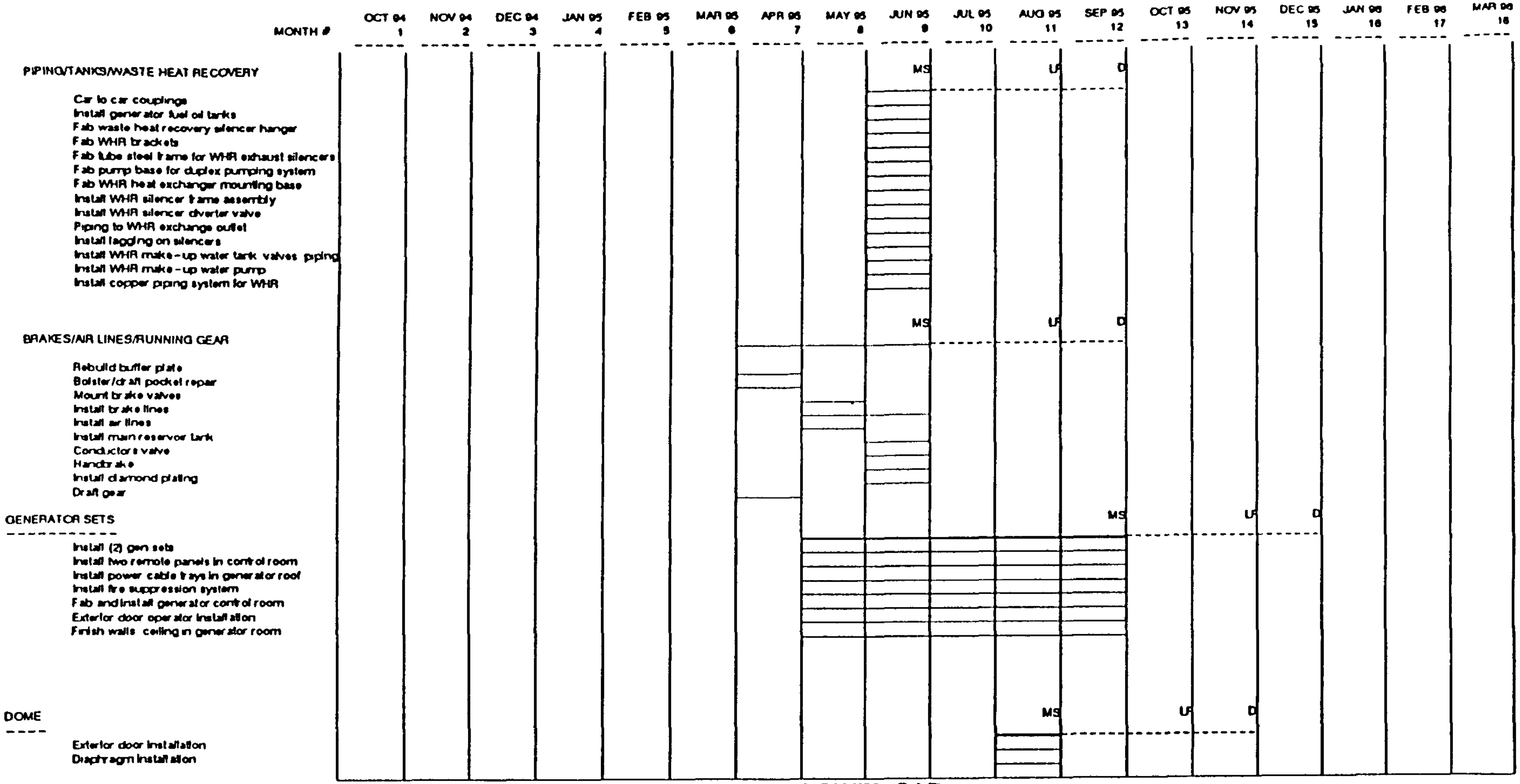
SPA CAR


MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PRODUCTION CARS 15 16 17
CREW CARS
PAINTING
Interior painting
Exterior prep
Exterior paint
Graphics application
UTILITIES – ALL
ELECTRICAL
HEP Brackets / conduit
Make up HEP runs
Place HEP runs under car
Junction box installation
Pulling old wire
Pulling undercar wire
Receptacle installation
Termination of wiring
Wire labeling
27 pin communication
Multiple Unit (MU)
Sound/Video system
220/480 v power
HVAC
Wiring/Controls/Thermostats
Test of HVAC system
CAR #1 MS
CAR #2 MS
CAR #3 MS
MS
LF
D
A

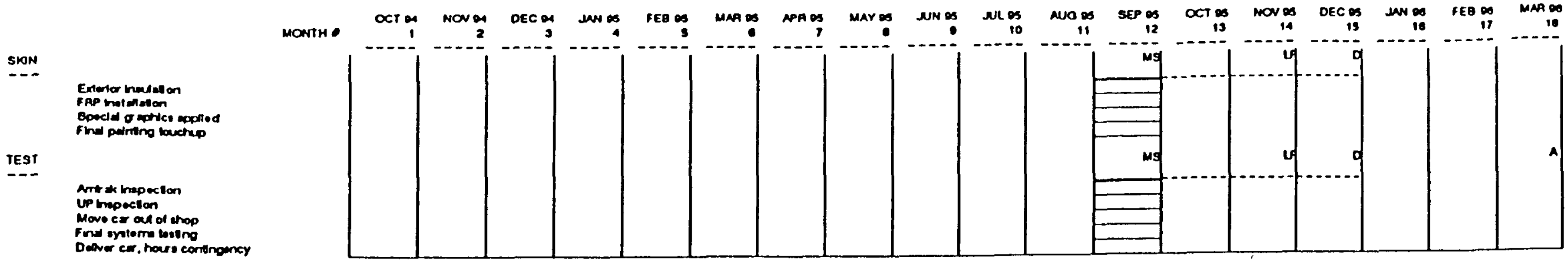
CREW CARS


MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
FLOORS (Ply-metal)
Reinforce floors for gen sets
1st floor panel installation
PAINTING (Ends and top)
A end metal skins
B end metal skins
Top of car
Inside of car
UTILITIES – ALL
ELECTRICAL
HEP Brackets / conduit
Make up HEP runs
Place HEP runs under car
Junction box installation
Fabricate electrical chases
Install chases
Center sill & bolster cuts
Fit and weld conduit transition box
Install conduit
Pulling undercar wire
Receptacle installation
Termination of wiring
Wire labeling
27 pin communication
Marker light conduit and wiring
Install battery boxes
Emergency lighting / conduit
General lighting, gen room, baggage control
220/480 v power
Waste Heat Recovery electrical wiring
Waste Heat Recovery electrical system
Electrical locker
DUCTING
Hole in roof for upper radiator duct, seal edges
Install prefab radiator exhaust duct
Cut holes in side of car for air intake louvers
MS
LF
D

POWER CAR


MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PIPING/TANKS/WASTE HEAT RECOVERY
Car to car couplings
Install generator fuel oil tanks
Fab waste heat recovery silencer hanger
Fab WHR brackets
Fab tube steel frame for WHR exhaust silencers
Fab pump base for duplex pumping system
Fab WHR heat exchanger mounting base
Install WHR silencer frame assembly
Install WHR silencer diverter valve
Piping to WHR exchange outlet
Install lagging on silencers
Install WHR make-up water tank valves piping
Install WHR make-up water pump
Install copper piping system for WHR
BRAKES/AIR LINES/RUNNING GEAR
Rebuild buffer plate
Bolster/draft pocket repair
Mount brake valves
Install brake lines
Install air lines
Install main reservoir tank
Conductors valve
Handbrake
Install diamond plating
Draft gear
GENERATOR SETS
Install (2) gen sets
Install two remote panels in control room
Install power cable trays in generator roof
Install fire suppression system
Fab and install generator control room
Exterior door operator installation
Finish walls ceiling in generator room
DOME
Exterior door installation
Diaphragm installation
MS
LF
D

POWER CAR

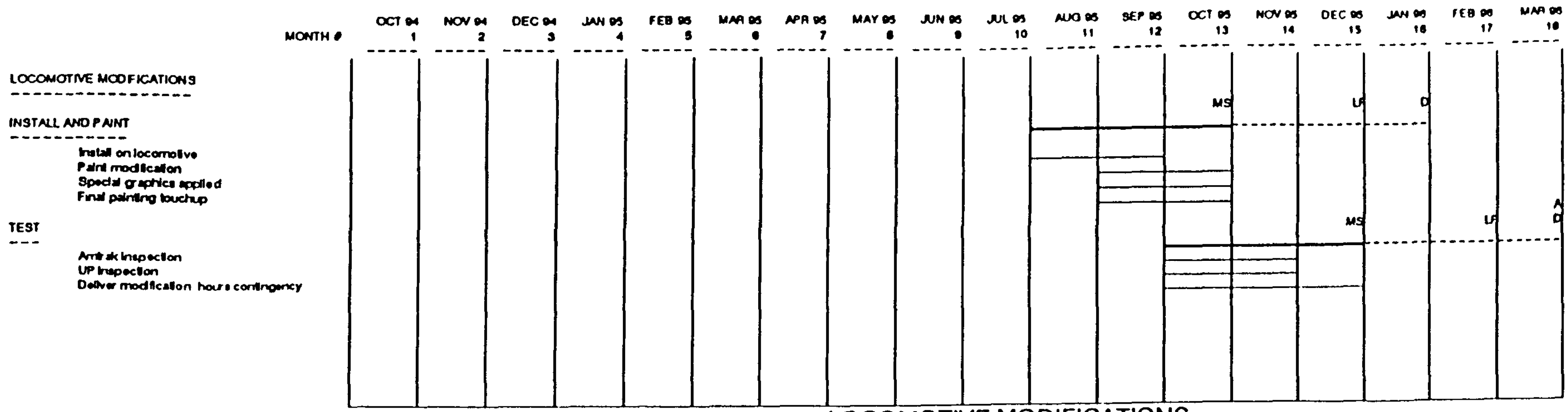


MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
SKIN
Exterior insulation
FRP installation
Special graphics applied
Final painting touchup
TEST
Amtrak inspection
UP inspection
Move car out of shop
Final systems testing
Deliver car, hours contingency
MS
LF
D
MS
LF
D
A

POWER CAR

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	0	0	1	2	3	3	2	1	3	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	1	3	6	9	11	12	15	15	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	1	2	3	3	2	1	3	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	1	3	6	9	11	12	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	0	1	2	3	3	2	1	3	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	0	1	3	6	9	11	12	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

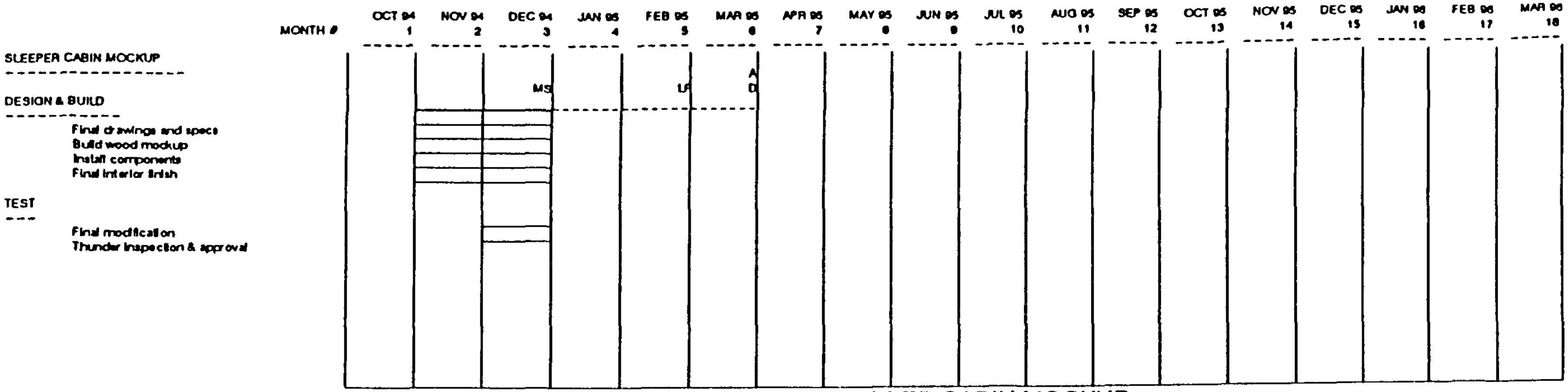
POWER CAR



LOCOMOTIVE MODIFICATIONS

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	2	2	2
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	2
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

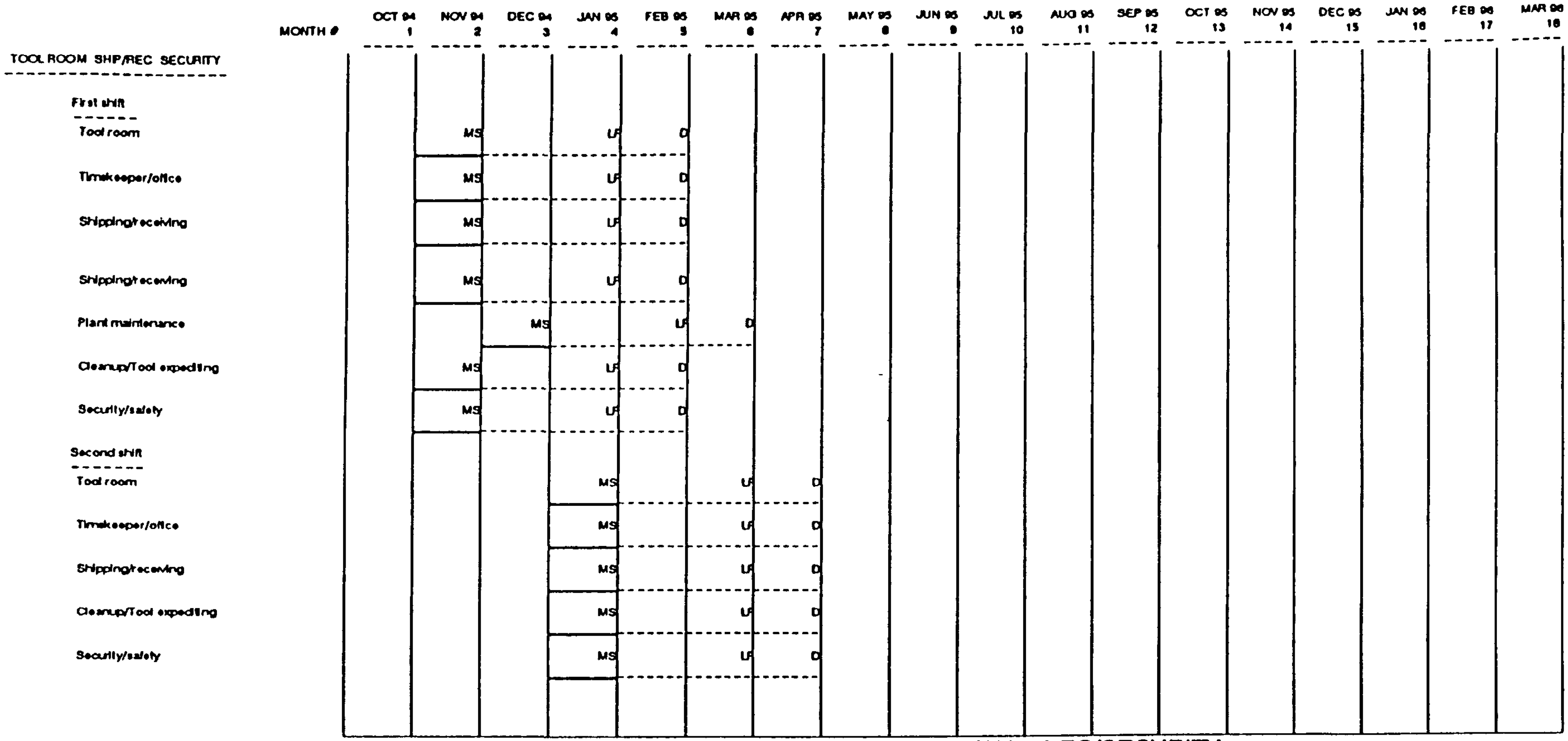
LOCOMOTIVE MODIFICATIONS



SLEEPER CABIN MOCKUP

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

SLEEPER CABIN MOCKUP



TOOL ROOM/SHIP REC/SECURITY

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	6	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	6	7	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	6	1	5	0	0	0	0	0	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	6	7	12	12	12	12	12	12	12	12	12	12	12	12	12
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	6	1	5	0	0	0	0	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	6	7	12	12	12	12	12	12	12	12	12	12	12	12
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

TOOL ROOM/SHIP REC/SECURITY

MONTH #	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

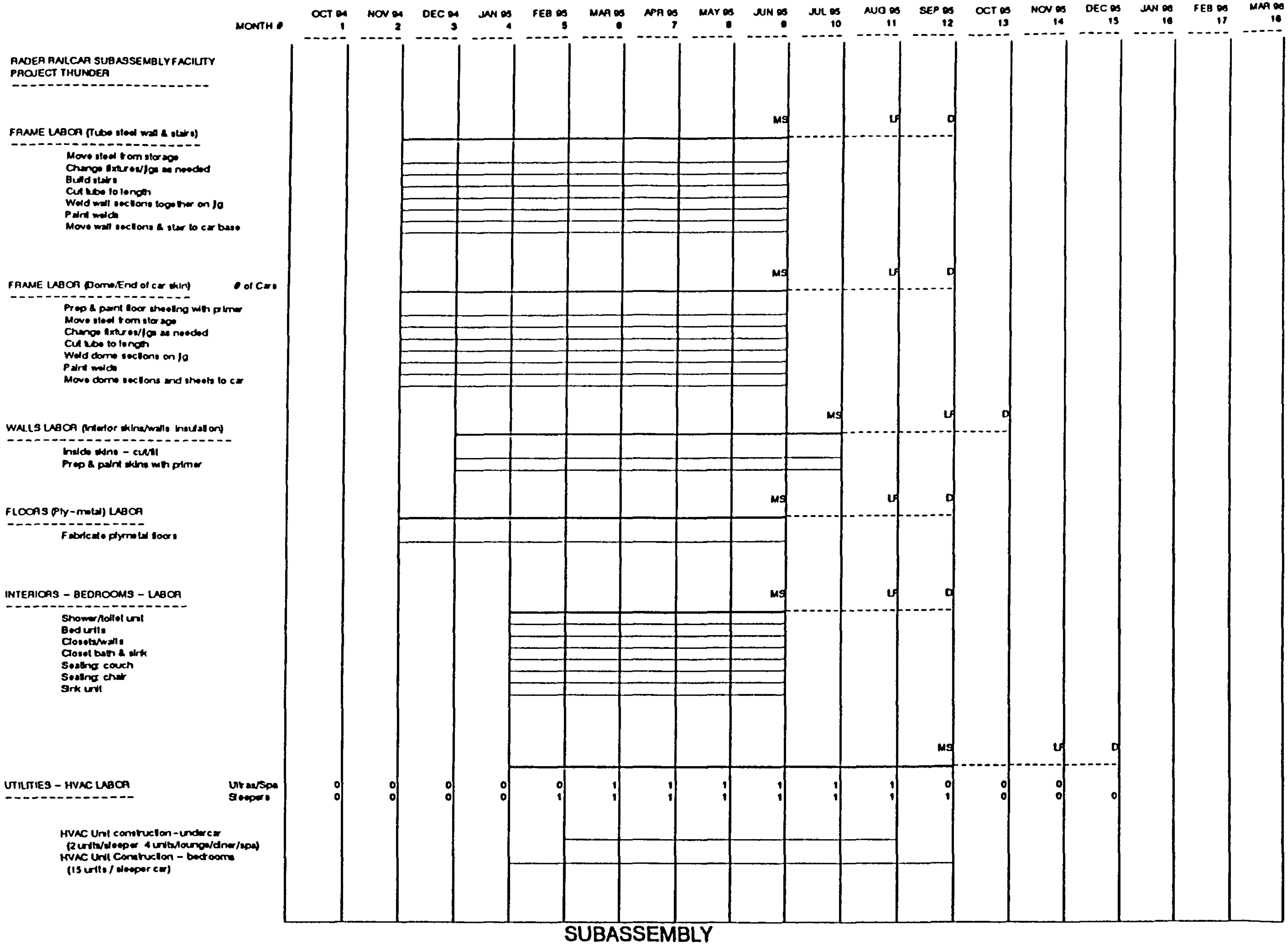
PURCHASING & SUBCONTRACTING MILESTONES

	MS	LF	D
INITIAL ORDERING OF ON-CAR MATERIAL			
Frames	NOV 94	JAN 95	FEB 95
Walls	DEC 94	FEB 95	MAR 95
Floors	DEC 94	FEB 95	MAR 95
Paint	DEC 94	FEB 95	MAR 95
Electrical items	DEC 94	FEB 95	MAR 95
HVAC	FEB 95	APR 95	MAY 95
Plumbing	FEB 95	APR 95	MAY 95
Glass-diners	JAN 95	MAR 95	APR 95
Glass-sleepers	FEB 95	APR 95	MAY 95
FRP tooling	JAN 95	MAR 95	APR 95
Interiors - carpet	FEB 95	APR 95	MAY 95
Interiors - wallcoverings	FEB 95	APR 95	MAY 95
Interiors - tables	FEB 95	APR 95	MAY 95
Interiors - cabinets	FEB 95	APR 95	MAY 95
Hottubs	FEB 95	APR 95	MAY 95
Crew car refurbishments	JAN 95	MAR 95	APR 95
Handrails	FEB 95	APR 95	MAY 95
Proto sleeper mockup	DEC 94	FEB 95	MAR 95
Platform	MAR 95	MAY 95	JUN 95
Tile	FEB 95	APR 95	MAY 95
INITIAL ORDERING OF SUBASSEMBLY MATERIAL			
Tube steel	OCT 94	DEC 94	JAN 95
Tube bending for domes	NOV 94	JAN 95	FEB 95
Star steel	NOV 94	JAN 95	FEB 95
Sheet steel roof dome floor ends	NOV 94	JAN 95	FEB 95
Interior skins	DEC 94	FEB 95	MAR 95
Insulation	DEC 94	FEB 95	MAR 95
Plymetal floor / components	DEC 94	FEB 95	MAR 95
Bedroom components	JAN 95	MAR 95	APR 95
HVAC components	FEB 95	APR 95	MAY 95
In room HVAC units	FEB 95	APR 95	MAY 95
Trucks parts	NOV 94	JAN 95	FEB 95
INITIAL ORDERING OF SUBCONTRACTING			
Floor pans	JAN 95	MAR 95	APR 95
Electrical panels	DEC 94	FEB 95	MAR 95
HVAC Plumbing	APR 95	JUN 95	JUL 95
Plumbing	JAN 95	MAR 95	APR 95
Interiors			
Cabinets	MAR 95	MAY 95	JUN 95
Corian	MAR 95	MAY 95	JUN 95
Seats	MAR 95	MAY 95	JUN 95
Wallpapering	MAR 95	MAY 95	JUN 95
Carpet laying	MAR 95	MAY 95	JUN 95
Paracube	MAR 95	MAY 95	JUN 95
Bars	MAR 95	MAY 95	JUN 95
Dance Floors	MAR 95	MAY 95	JUN 95
Stainless steel kitchen counters	FEB 95	APR 95	MAY 95
Kitchen equipment	FEB 95	APR 95	MAY 95
RRC RAILCAR PURCHASES			
Crew Cars	FEB 95	APR 95	MAY 95

PURCHASING & SUBCONTRACTING

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	1	5	9	6	15	9	1	0	0	0	0	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	1	6	15	21	36	45	46	46	46	46	46	46	46	46	46	46	46	46
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	1	5	9	6	15	9	1	0	0	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	1	6	15	21	36	45	46	46	46	46	46	46	46	46	46	46
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	1	5	9	6	15	9	1	0	0	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	1	6	15	21	36	45	46	46	46	46	46	46	46	46	46
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

PURCHASING & SUBCONTRACTING

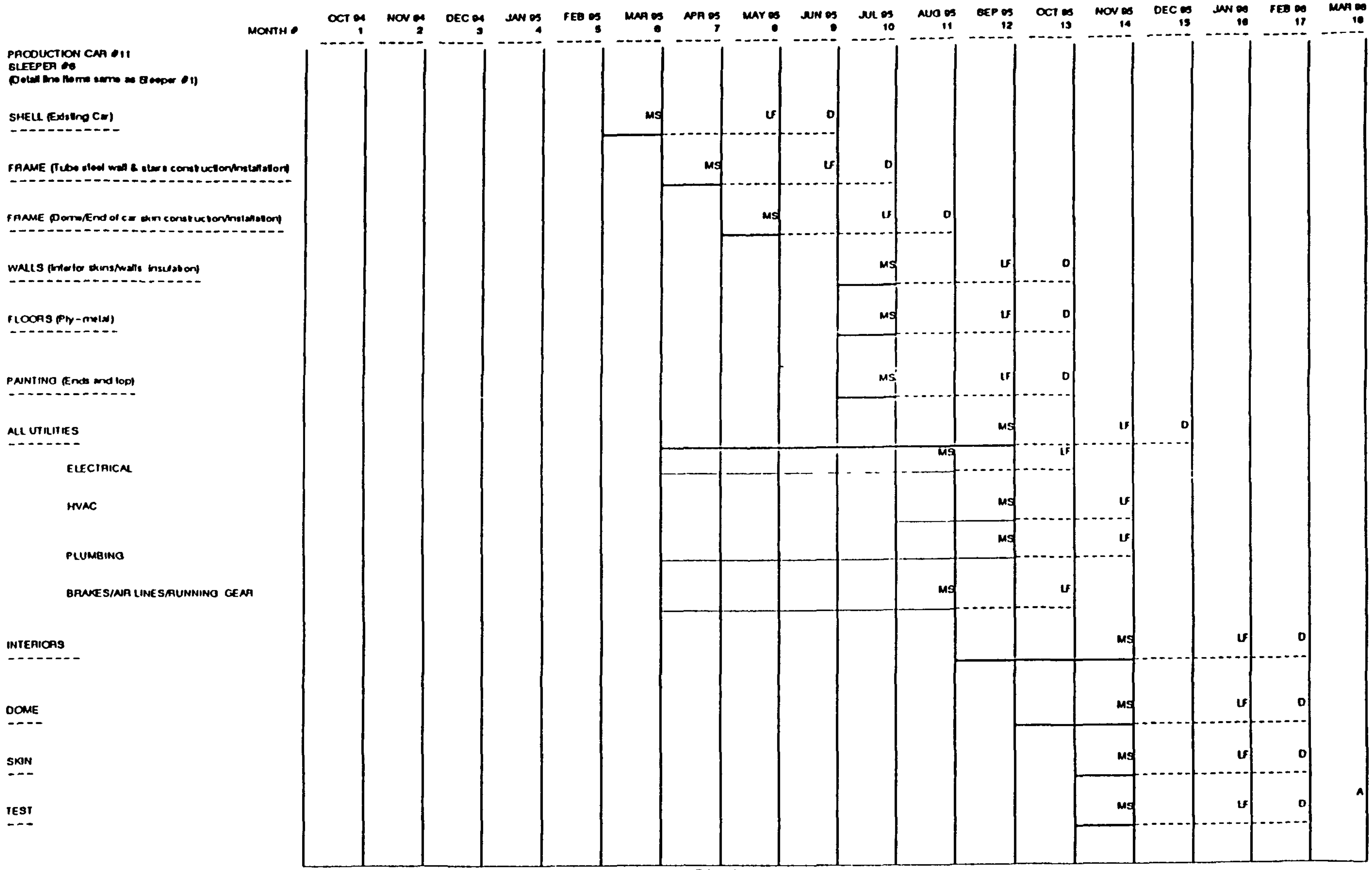

RADER RAILCAR SUBASSEMBLY FACILITY
PROJECT THUNDER
MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
FRAME LABOR (Tube steel wall & stairs)
MS
LF
D
Move steel from storage
Change fixtures/jigs as needed
Build stairs
Cut tube to length
Weld wall sections together on jig
Paint welds
Move wall sections & stair to car base
FRAME LABOR (Dome/End of car skin)
# of Cars
MS
LF
D
Prep & paint floor sheeting with primer
Move steel from storage
Change fixtures/jigs as needed
Cut tube to length
Weld dome sections on jig
Paint welds
Move dome sections and sheets to car
WALLS LABOR (Interior skins/walls insulation)
MS
LF
D
Inside skins – cut/fit
Prep & paint skins with primer
FLOORS (Ply-metal) LABOR
MS
LF
D
Fabricate plymetal floors
INTERIORS – BEDROOMS – LABOR
MS
LF
D
Shower/toilet unit
Bed units
Closets/walls
Closet bath & sink
Seating couch
Seating chair
Sink unit
UTILITIES – HVAC LABOR
MS
LF
D
Ultras/Spa 0 0 0 0 0 1 1 1 1 1 1 0 0 0
Sleepers 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0
HVAC Unit construction – undercar
(2 units/sleeper 4 units/lounge/diner/spa)
HVAC Unit Construction – bedrooms
(15 units / sleeper car)
SUBASSEMBLY

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	0	4	1	0	1	0	0	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	0	4	5	5	6	6	6	6	6	6	6
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	0	0	0	4	1	0	1	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	0	0	0	4	5	5	6	6	6	6	6
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	0	0	0	0	4	1	0	1	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	0	0	0	0	4	5	5	6	6	6	6
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

SUBASSEMBLY

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	1	2	3	3	6	8	11	12	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	1	1	1	0	3	2	3	1	3	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	1	2	3	3	6	8	11	12	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DEFAULTS																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	0	1	1	1	0	3	0	1	1	3	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	0	0	0	1	2	3	3	6	6	7	8	11	11
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

SLEEPER #5


MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PRODUCTION CAR #11
SLEEPER #6
(Detail line items same as Sleeper #1)
SHELL (Existing Car)
FRAME (Tube steel wall & stairs construction/installation)
FRAME (Dome/End of car skin construction/installation)
WALLS (Interior skins/walls insulation)
FLOORS (Ply-metal)
PAINTING (Ends and top)
ALL UTILITIES
ELECTRICAL
HVAC
PLUMBING
BRAKES/AIR LINES/RUNNING GEAR
INTERIORS
DOME
SKIN
TEST
MS
LF
D
A

SLEEPER #6

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
PRODUCTION MILESTONES																		
PER PERIOD																		
Plan	0	0	0	0	0	1	1	1	0	3	2	3	0	4	0	0	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
Plan	0	0	0	0	0	1	2	3	3	6	8	11	11	15	15	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
LATE FINISHES																		
PER PERIOD																		
Plan	0	0	0	0	0	0	0	1	1	1	0	3	2	3	0	4	0	0
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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CUMULATIVE																		
Plan	0	0	0	0	0	0	0	1	2	3	3	6	8	11	11	15	15	15
Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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DEFAULTS																		
PER PERIOD																		
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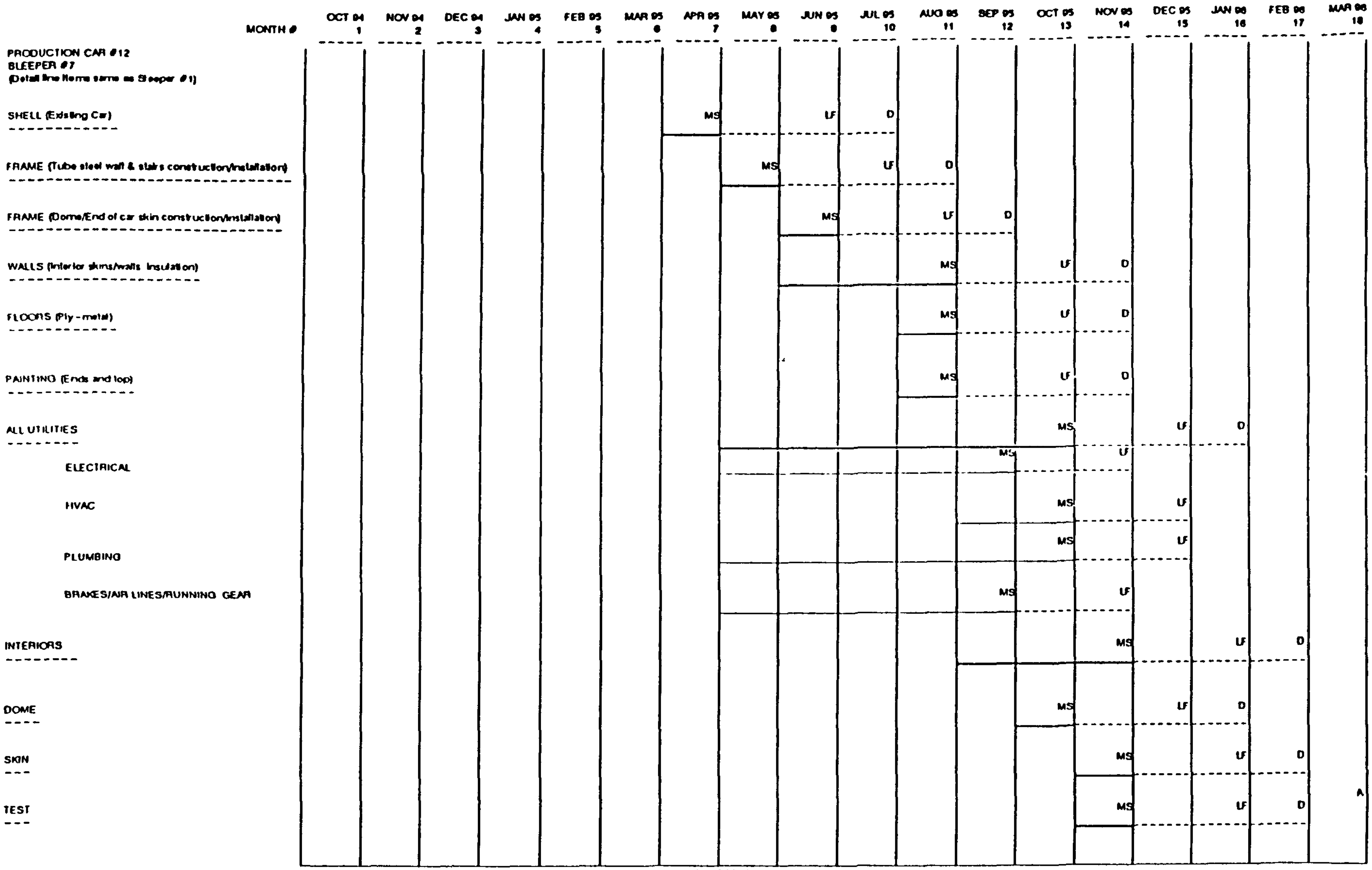
Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

SLEEPER #6



MONTH #
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PRODUCTION CAR #12
SLEEPER #7
(Detail line items same as Sleeper #1)
SHELL (Existing Car)
FRAME (Tube steel wall & stairs construction/installation)
FRAME (Dome/End of car skin construction/installation)
WALLS (Interior skins/walls Insulation)
FLOORS (Ply-metal)
PAINTING (Ends and top)
ALL UTILITIES
ELECTRICAL
HVAC
PLUMBING
BRAKES/AIR LINES/RUNNING GEAR
INTERIORS
DOME
SKIN
TEST
MS
LF
D
A

SLEEPER #7

MONTH #	OCT 94 1	NOV 94 2	DEC 94 3	JAN 95 4	FEB 95 5	MAR 95 6	APR 95 7	MAY 95 8	JUN 95 9	JUL 95 10	AUG 95 11	SEP 95 12	OCT 95 13	NOV 95 14	DEC 95 15	JAN 96 16	FEB 96 17	MAR 96 18
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PER PERIOD																		
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LATE FINISHES																		
PER PERIOD																		
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DEFAULTS																		
PER PERIOD																		
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Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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CUMULATIVE																		
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Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

SLEEPER #7

SCHEDULE F

BASE RAILCARS

CAR NUMBER	DESCRIPTION
SP 3704	Pullman Std 1955
SP 3710	ACF 1957
SP 3711	ACF 1957
SP 3716	ACF 1957
SP 3725	ACF 1957
SP 3728	ACF 1957
SP 3731	Pullman Std 1969
SP 3732	Pullman Std 1969
SP 3733	Pullman Std 1969
SP 3735	Pullman Std 1969
SP 3736	Pullman Std 1969
SP 3737	Pullman Std 1969
SP 3739	Pullman Std 1969
SOO 620	Diner/Kitchen Car
	Baggage Car

TTC
Transportation
Test
Center

ASSOCIATION
OF AMERICAN
RAILROADS
Research & Test Department

Vehicle/Guideway Systems Research
(719) 584-0580

Box 11130
Pueblo, Colorado 81001

Fax (719)584-0672

June 25, 1993
VGSR/SEM/93-097

Mr. Thomas Rader
Rader Railcar, Inc.
10700 East 40th Avenue
Denver, CO 80239

Dear Tom,

Enclosed is a copy of the draft ASME paper I have been asked to present in October at the 1993 ASME Winter Annual Meeting (WAM) in Pueblo. The theme of the meeting is Ride Quality, and I think this paper would be of interest to many of the participants.

The paper generally describes the Ultradome Car Ride Quality Improvement project. I have tried to leave out any specific information concerning the tour company, the car manufacturer, the make of the tour cars, the truck model, etc. I hope that you will find the paper acceptable for publication and presentation at the ASME WAM meeting.

Also, I thought that you might be interested in setting up a Rader Railcar, Inc. exhibit booth at the meeting. If so, please let me know and I will send you some information for exhibitors.

In closing, I would like to thank you for allowing us to present this paper.

Sincerely,

Stephen Mace

Stephen Mace

Enclosure (ASME paper)

SEM/amw

cc: M. Dembosky

RIDE QUALITY IMPROVEMENTS TO PASSENGER RAIL SERVICE: A CASE STUDY

Stephen E. Mace
Association of American Railroads
Pueblo, Colorado

ABSTRACT

The Association of American Railroads' (AAR) NUCARS program was used to investigate means of improving the ride quality of rail cars used in a private passenger rail service. At speeds of approximately 50 mph, these cars exhibited a pronounced whole-body yaw motion that caused considerable rider discomfort. The yaw motion was thought to be generated by lateral vibrations transmitted to the car body from the trucks, which oscillated laterally on track sections having low or wide rail joints.

A detailed model of the car was developed with the NUCARS program. Simulations were performed for the model operating over track with low/wide rail joints. The model trucks exhibited lateral vibrations that caused the car body to yaw. The greatest car body yaw motion occurred at speeds between 45 mph and 50 mph, where the frequency of the track joints coincided with the cars' yaw vibration natural frequency.

The NUCARS simulation indicated that lowering the cars' yaw natural frequency would dramatically reduce the lateral vibrations transmitted from the trucks to the car bodies. The simulation also demonstrated that providing a lateral hydraulic damper at each truck would also offer some additional improvement in ride quality. Based on these results, modifications to the cars' suspensions were recommended. Subsequent tests confirmed that the modified cars exhibited much improved ride quality.

BACKGROUND

Passenger cars operating in a private tour service exhibited poor ride quality due to excessive lateral vibration of the car body. The lateral vibration resulted from a pronounced car body yaw motion (yaw refers to the motion of a car body, illustrated in Figure 1, when the ends move laterally 180 degrees out of phase), which was most pronounced at speeds between 45 mph and 50 mph. Also, the poor ride quality was observed only on the tour route, which consisted of track with jointed rails. The cars exhibited good ride quality on tracks having welded rails.

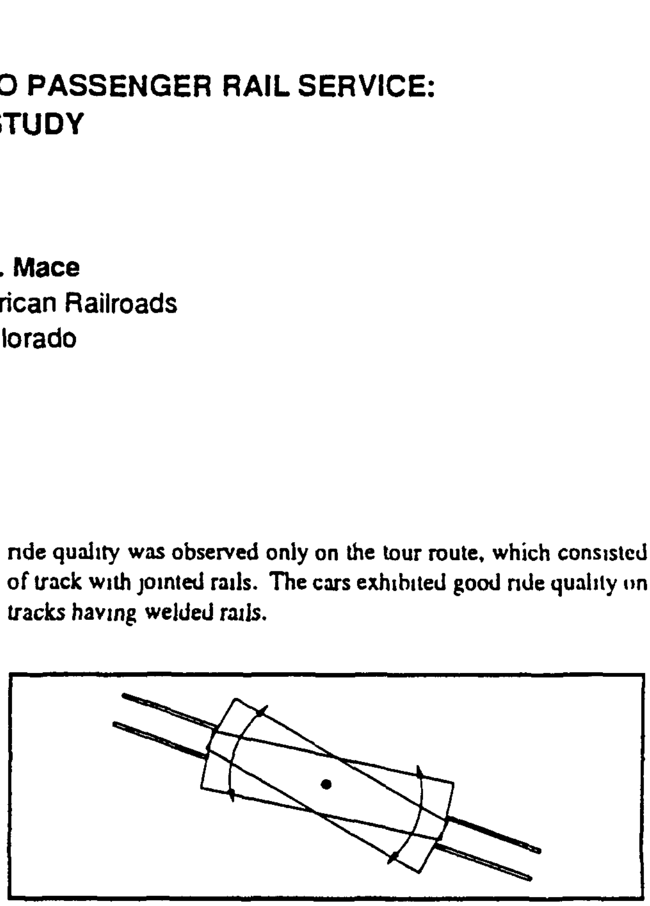

FIGURE 1. CAR BODY YAW MOTION

Previous work had been conducted to determine the cause of the poor ride quality. Although inconclusive, the earlier study indicated that the car body yaw motion was caused by lateral vibrations transmitted from the trucks, which exhibited severe lateral oscillations induced by the track. The study also reported that excessive wheel wear was observed on all of the tour cars.

The AAR proposed to improve the ride quality of the tour cars through the use of NUCARS, a computer program developed to simulate the behavior of rail cars. The project consisted of the following five phases: (1) a preliminary ride quality analysis, (2) rigid body mode vibration tests, (3) development of the NUCARS car and track models, (4) NUCARS model analysis, and (5) implementation of selected modifications with final ride quality analysis.

PRELIMINARY RIDE QUALITY ANALYSIS

The first phase of the project consisted of a preliminary analysis of the tour car ride quality. Ride quality data were collected during operation of the tour cars over their revenue service route.

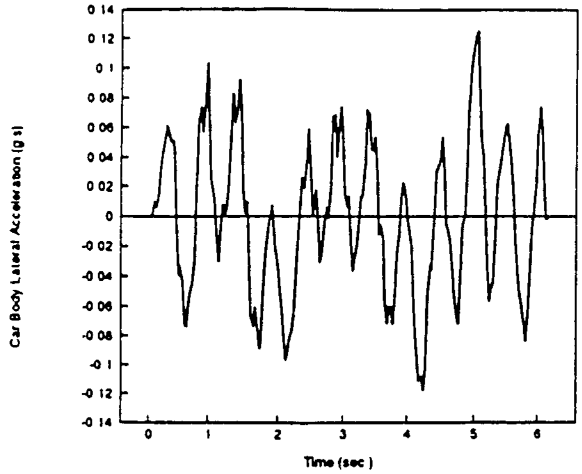

FIGURE 2. TOUR CAR LATERAL ACCELERATION

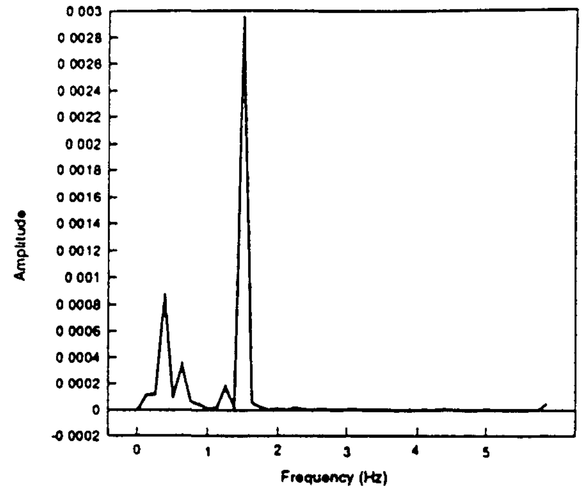

FIGURE 3. TOUR CAR LATERAL ACCELERATION PSD

Figure 2 is a plot of the tour car body leading end lateral acceleration measured on a tour car travelling at 45 mph The lateral vibration amplitude reached a maximum level of 0 1 g's peak The power spectral density (PSD) plot of the lateral vibration in Figure 3 reveals that the vibration frequency was almost exclusively at 1 7 Hz

Table 1 contains the measured leading axle lateral acceleration frequencies and calculated 39-foot rail joint frequencies at various speeds Note that the axle lateral acceleration frequency nearly matches the rail joint frequency at each speed This result indicates that the lateral truck vibrations were caused by perturbed joints in the track In addition, wheel profile traces taken from the test car revealed that the wheels were worn hollow in the tread. It is well known that, because of their high effective conicity, worn wheels have little damping to resist lateral oscillations

TABLE 1 AXLE ACCELERATION AND RAIL JOINT FREQUENCIES

Speed (mph)	*Measured Axle Lat Accel Frequency (Hz)*	*39-ft Rail Joint Frequency (Hz)*
45	1 7	1 7
50	1 8	1 9
59	2 1	2.2

RIGID BODY MODE VIBRATION TESTS

The tour car suspension was analyzed using rigid body mode vibration tests The procedure for these tests consisted of exciting the car in several rigid body vibration modes and recording the resulting vibrations Depending on the frequency and phasing of the excitation, several rigid body vibration modes were induced Table 2 lists these modes and the frequencies of vibration measured for each Note that the yaw mode frequency was found to be 1 8 Hz, which is quite high for this vibration mode The 1 8 Hz frequency was identical to the frequency of lateral vibration measured during the track test at 50 mph

TABLE 2. TOUR CAR RIGID BODY MODE FREQUENCIES

Rigid Body Mode	*Frequency (Hz)*
Bounce	2.1
Pitch	2.5
Yaw	1.8
Lower Center Roll	0.7
Upper Center Roll	2 1

From the results of the ride quality analysis and rigid body mode vibration tests, the following hypothesis was developed to explain the poor ride quality of the tour cars. First, a combination of severely worn wheel profiles and perturbed track joints caused the tour car trucks to oscillate laterally This vibration caused lateral forces to be transmitted to the car body through the suspension Because the track joints were staggered, these forces excited the car body in yaw, as shown in Figure 4

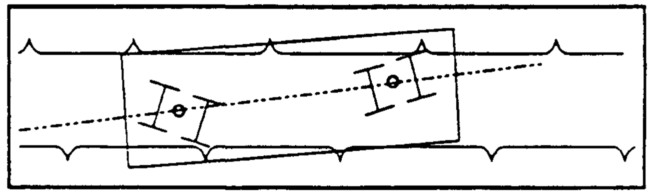

FIGURE 4 STAGGERED LOW/WIDE RAIL JOINTS

At 50 mph, the rail joint excitation frequency coincided with the cars' rigid body yaw vibration frequency of 1 8 Hz, and the lateral vibration magnitude reached its maximum amplitude at this speed

NUCARS MODEL DEVELOPMENT

Models of the tour cars and tracks were developed using the NUCARS program The car model was developed through rigid body mode vibration tests, visual inspections, design drawings and manufacturer's specifications for the suspension components The track model development was based on a mathematical representation of track with low/wide rail joints.

Car Model

The tour cars were double-deck cars with 60 foot truck centers The truck design utilized equalizer beams connected to the rigid truck frame through coil-type equalizer springs. The truck frame was, in turn, connected to the bolster by inclined swing hangers supporting inboard coil-type bolster springs A unique feature of this truck design was the substitution of roll stabilizers between the bolster and swing hangers for the more common spring planks This feature, which dramatically increased the roll stiffness of the suspension, was probably included to control the excessive roll motion that frequently occurs in tall cars having high centers of gravity

The NUCARS car model development required the following: (1) wheel and rail profiles, (2) car body and truck component weights, dimensions, mass moments of inertia and center of gravity heights, and (3) suspension element characteristics

Because accurate wheel and rail profile measurements were not available, new CN Heumann wheel profiles were used on 136-pound rail profiles It was decided that the new CN Heumann wheel profiles would conservatively represent the actual severely worn wheel profiles of the tour cars

Car body and truck component dimensions and weights were obtained from the manufacturer's specifications Mass moments of inertia were computed for each component based on its geometry. The center of gravity of the car body was calculated from the lower and upper center roll vibration frequencies measured in the rigid body mode vibration tests Truck component center of gravity heights were calculated from their dimensions.

Suspension element characteristics were obtained from the manufacturer's specifications and from rigid body mode vibration tests Vertical spring stiffness values, for example, were simply taken from the manufacturer's specifications However, problems were encountered estimating the lateral stiffness of the swing hanger suspension, as described below

The theoretical lateral stiffness of swing hangers can be calculated from their pivot length and inclination Figure 5 is a diagrammatic representation of a swing hanger suspension The swing hangers are inclined to increase the stiffness of the suspension For small oscillations and inclinations of the hangers, the frequency of vibration can be computed using Equation 1 (Cain, 1940) below

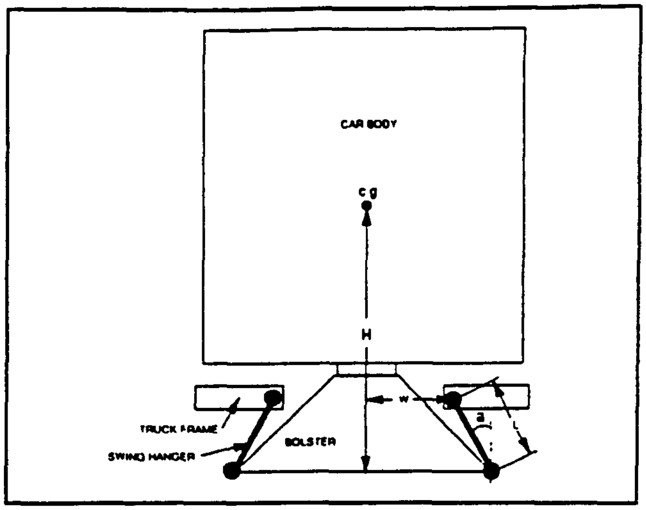

FIGURE 5. SWING HANGER SUSPENSION GEOMETRY

$$f=\frac{1}{2\pi}\sqrt{\frac{g}{L}\left\{1+\frac{2(H+L)}{W}\sin a\right\}} \tag{1}$$

where:

f	= swing hanger suspension frequency (Hz)
g	= acceleration of gravity (in/sec^2)
L	= swing hanger length (in)
H	= c.g. height above lower pivot (in)
W	= half spacing of upper pivots (in)
a	= swing hanger inclination angle (deg.)

For the tour car swing hanger geometry, this equation yielded a frequency of approximately 1.2 Hz. If this value accurately represented the frequency of the actual swing hanger suspension, then the yaw mode vibration, which is simply a form of lateral suspension excitation, would have exhibited the same frequency However, a frequency of 1.8 Hz was measured for yaw vibration in the rigid body mode vibration and track tests. Apparently, the lateral stiffness of the tour car swing hanger suspension was increased by some mechanism.

Further investigation into the tour car suspension revealed that the bolster roll stabilizers produced a strong coupling between the truck's lateral swing hanger suspension and roll suspension Figure 6 illustrates that, when the inclined swing hangers are deflected laterally, the connection between them must roll If the swing hangers are connected by a spring plank, then the spring plank rolls and most of the deflection is taken up by the bolster springs However, if the swing hangers are connected by roll stabilizers, as they are in the tour cars, then the bolster springs cannot deflect, and the car body must roll, as shown in Figure 7 Thus, a strong coupling is produced between the lateral swing hanger suspension and roll suspension of the car. Because a lateral deflection of the swing hangers requires the car body to roll also, the result is an increase in the lateral suspension stiffness of the tour car.

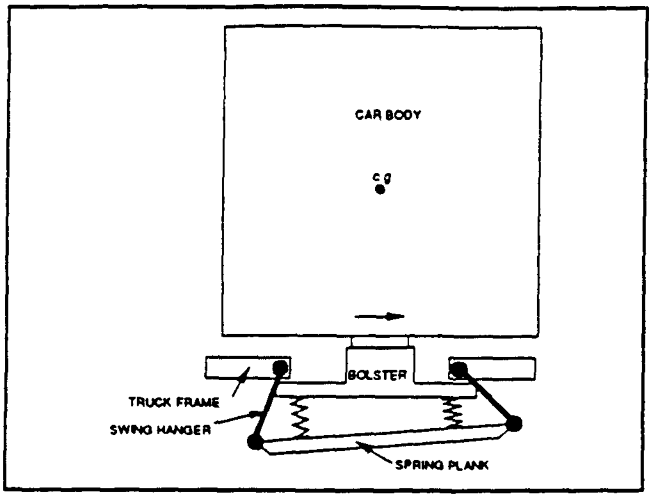

FIGURE 6. SWING HANGERS WITH SPRING PLANK

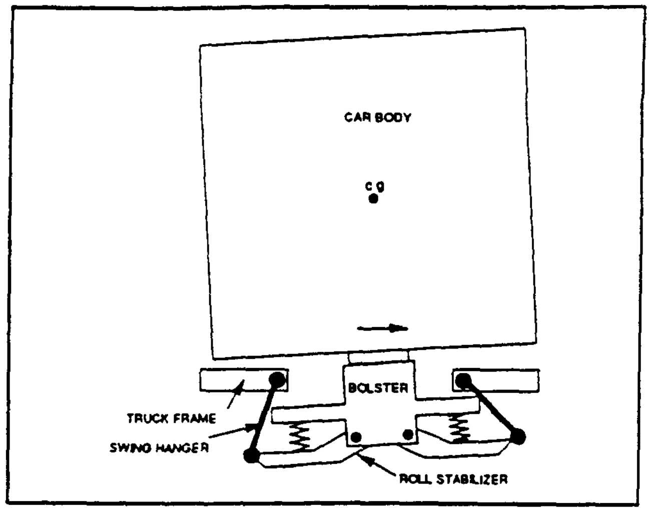

FIGURE 7. SWING HANGERS WITH ROLL STABILIZER

For the NUCARS model, an appropriate lateral suspension stiffness was calculated based on the rigid body mode test yaw vibration frequency of 1 8 Hz using Equations 2 and 3 (Cain, 1940) below

$$k_y = I_y(2\pi f)^2 \qquad (2)$$

$$k_l = \frac{k_y}{2ml^2} \qquad (3)$$

where

k_y = yaw rotational stiffness (pound-in/rad)

I_y = yaw rotational inertia (pound-in-sec^2)

f = measured yaw frequency (Hz)

k_l = lateral suspension stiffness/truck (pounds/in)

m = car body mass (slugs)

These equations yielded a lateral suspension stiffness of 12,483 pounds/in per truck.

Track Model

A mathematical representation of track with low/wide rail joints was used as input to the NUCARS model The rail joints were staggered on 39-foot centers with 0 5 inch amplitude dips and 0 3 inch wide cusps

NUCARS MODEL ANALYSIS

The NUCARS analysis consisted of analyzing the ride quality of three tour car model configurations running on tangent track with staggered wide/low rail joints The following three configurations were analyzed (1) the tour car with roll stabilizers (2) the tour car with spring planks, and (3) the tour car with spring planks and lateral dampers In addition, the three model configurations were run at lower speeds on tangent track with severe cross-level perturbations and on curved track with high superelevation to determine if removing the roll stabilizers would adversely affect the roll stability of the tour car

The model of the tour car with roll stabilizers exhibited ride quality characteristics very similar to those measured during the track test Figure 8 is a plot of the car body leading end lateral acceleration measured during the track tests at 45 mph Figure 9 is a plot of the car body leading end lateral acceleration for the model running at 45 mph on the low/wide joint track. In both cases, the maximum amplitude of acceleration approaches 0.1 g Figures 10 and 11 are PSD plots of the same data, showing good correlation between the frequencies and amplitudes Other data from the track test and from the model were compared and found to have good correlation, confirming that a reasonably accurate model of the tour cars had been produced

As discussed earlier, the tour car ride quality problem was attributed to lateral vibrations of the car body caused by truck oscillations induced by low/wide rail joints in the track These vibrations caused the car to yaw excessively at speeds near 50 mph because, at this speed, the frequency of truck oscillation matched the car's yaw frequency of 1.8 Hz. The logical remedy to this situation was simply to reduce the lateral suspension stiffness

It was decided that the best way to reduce the lateral suspension stiffness consisted of replacing the roll stabilizers with spring planks, thus eliminating the strong coupling between the lateral and roll suspensions of the trucks and allowing the swing hangers to function properly In addition, removing the roll stabilizers would allow the bolster springs to shear laterally, thus further softening the lateral suspension

The NUCARS model was modified with a spring plank connection between the swing hangers instead of the roll stabilizers Figure 12 is a plot of the modified model car body leading end lateral acceleration at 45 mph Compared to the acceleration shown in Figure 9, the acceleration amplitude has decreased by approximately 50 percent to less than 0 5 g's The PSD plot in Figure 13 also shows a significant reduction in amplitude for the model car equipped with spring planks

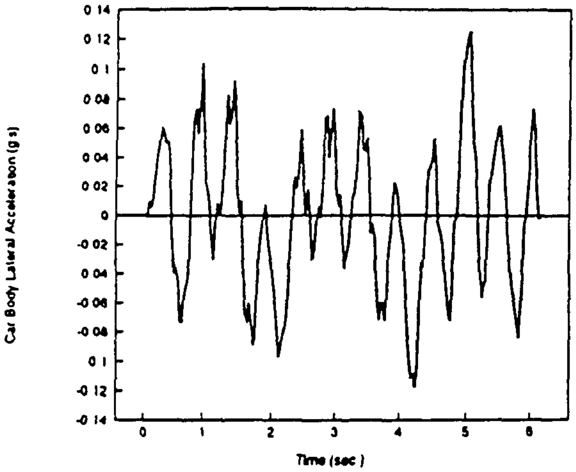

FIGURE 8 MEASURED TOUR CAR BODY LATERAL ACCELERATION - ROLL STABILIZER CAR

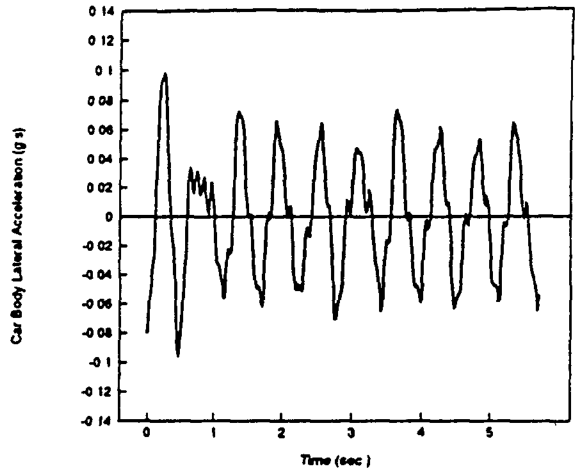

FIGURE 9. PREDICTED TOUR CAR BODY LATERAL ACCELERATION - ROLL STABILIZER CAR

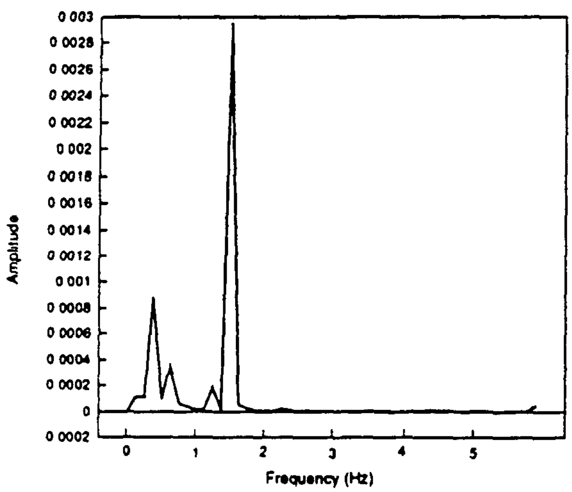

FIGURE 10 MEASURED TOUR CAR BODY LATERAL ACCELERATION PSD - ROLL STABILIZER CAR

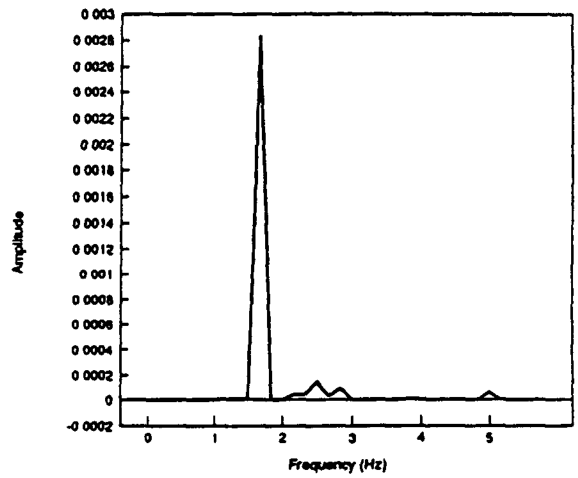

FIGURE 11. PREDICTED TOUR CAR BODY LATERAL ACCELERATION PSD - ROLL STABILIZER CAR

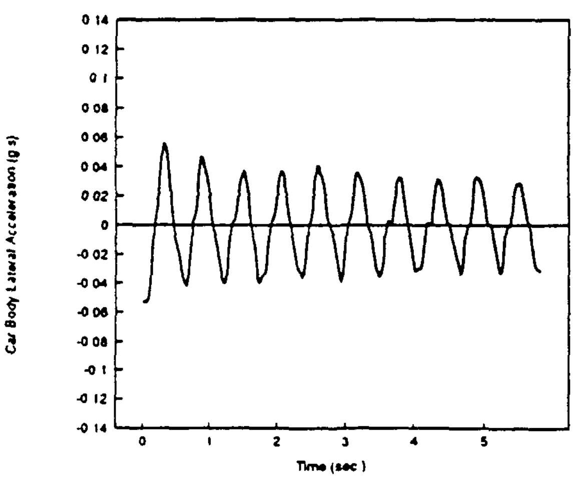

FIGURE 12. PREDICTED TOUR CAR BODY LATERAL ACCELERATION - SPRING PLANK CAR

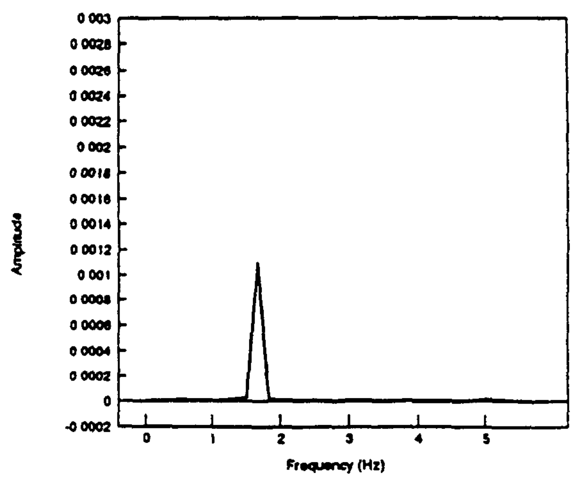

FIGURE 13. PREDICTED TOUR CAR BODY LATERAL ACCELERATION PSD - SPRING PLANK CAR

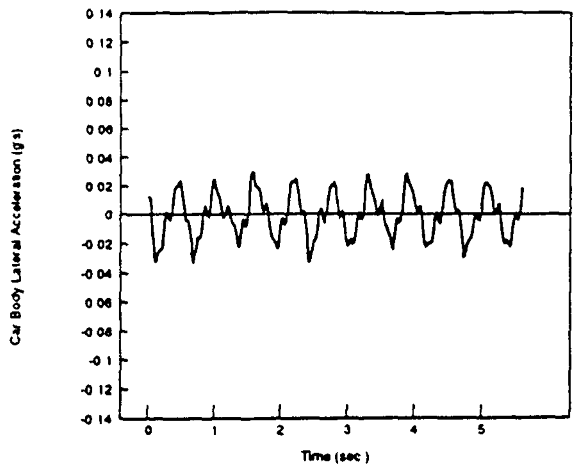

FIGURE 14. PREDICTED TOUR CAR BODY LATERAL ACCELERATION - SPRING PLANK/DAMPER CAR

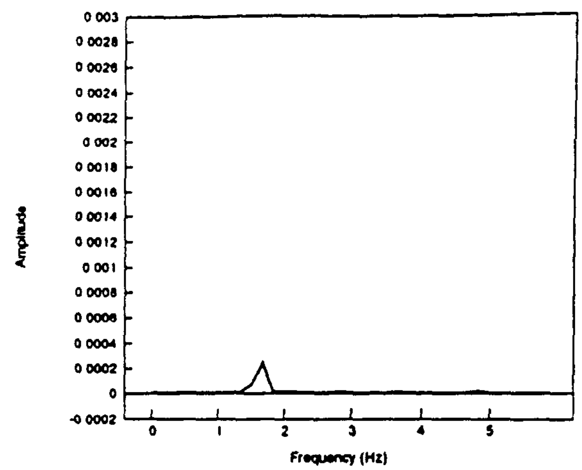

FIGURE 15. PREDICTED TOUR CAR BODY LATERAL ACCELERATION PSD - SPRING PLANK/DAMPER CAR

The spring plank car model was modified to include hydraulic dampers installed laterally between the bolsters and truck frames. Figures 14 and 15 are time history and PSD plot of the car body leading end lateral acceleration at 45 mph predicted by NUCARS Compared to the spring plank car without lateral dampers, the car body exhibits even lower lateral acceleration levels

NUCARS was used to compare the roll stability of the spring plank tour car model with that of the roll stabilizer tour car model Simulations were run in two track sections: (1) a tangent track having 0 75 inch cross-level perturbations and (2) a 10 degree curve track having 5 inches of high rail superelevation In the perturbed tangent track section, both models exhibited maximum car body roll angles of approximately 3 degrees peak-to-peak. In the curve, maximum car body roll angles of 0 5 degree and 1 0 degree were predicted for the roll stabilizer car model and spring plank car model, respectively These results indicated that replacing the roll stabilizers with spring planks would not significantly reduce the roll stability of the tour cars

TOUR CAR MODIFICATION AND FINAL RIDE QUALITY TEST

The encouraging results of the NUCARS model analysis prompted the replacement of roll stabilizers with spring planks in several tour cars First, rigid body mode vibration tests were conducted on one of the modified tour cars and a new yaw frequency of approximately 1 Hz was measured Then, the modified tour cars were tested over the same track as in the original ride quality test. Figures 16 and 17 are time history and PSD plots of the tour car body leading end lateral acceleration at 45 mph Compared to the unmodified car plots in Figures 2 and 3, the amplitude of vibration has decreased dramatically, indicating that the ride quality of the modified tour cars was much improved

REFERENCES

Cain, B.S , 1940, "Vibration of Rail and Road Vehicles," Pitman Publishing Corporation, New York, N.Y.

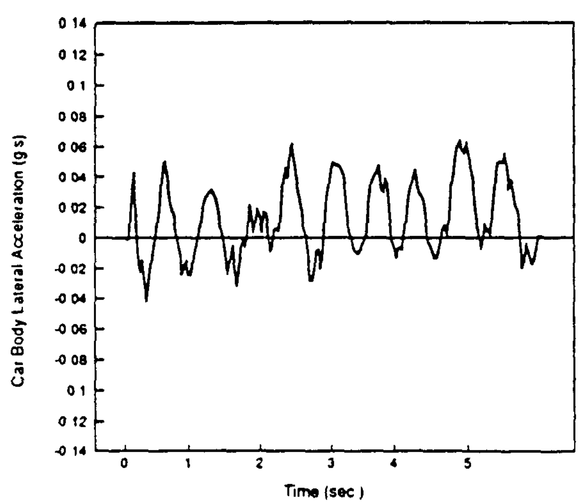

FIGURE 16 MEASURED TOUR CAR BODY LATERAL ACCELERATION - SPRING PLANK CAR

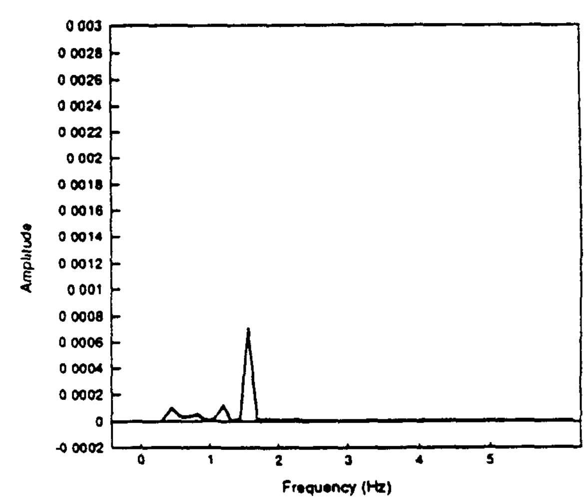

FIGURE 17 MEASURED TOUR CAR BODY LATERAL ACCELERATION PSD - SPRING PLANK CAR

Transportation Test Center

ASSOCIATION OF AMERICAN RAILROADS
Research & Test Department

Research & Technology Developm
(719) 584-05
Box 111
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Telefax (719) 584-06

October 9, 1992
VGSR/SEM/92-116

Thomas Rader
Rader Railcar, Inc.
10700 East 40th Avenue
Denver, CO 80239

Dear Tom,

Enclosed are plots of the car body lateral accelerations for the gallery car with the spring plank modification tested on September 30. Note that the frequency dropped from 1.68 Hz to less than 1 Hz (Figure 1) when the roll stabilizers were replaced with spring planks. This modification should dramatically improve the lateral or yaw motion ride quality of the Ultradome cars.

As I mentioned earlier, the yaw and roll modes of the cars are very closely coupled by the roll stabilizers. The roll stabilizers bypass the bolster spring and seat shear (lateral) suspension and virtually eliminate roll freedom between the truck frame and bolster. Also, the two swing hangers connecting each truck frame to the bolster are not parallel. As a result, the car body must roll when the swing links deflect. This effectively increases the lateral suspension stiffness dramatically. I believe that this explains the unusually high yaw frequency, not the swing hanger friction as I concluded earlier. To verify this, I modified the NUCARS model and ran some cases, as described below.

From the previous yaw tests with roll stabilizers, I calculated that the lateral suspension stiffness was approximately 12,000 pounds/in. This new lateral suspension stiffness was incorporated into the Ultradome car NUCARS model (with roll stabilizers) along with lower (500 pounds) swing link friction. At 50 mph on low-jointed track, the model predicted car body lateral acceleration levels of 0.08 gravities peak, which were very similar to those recorded during the track tests (Figure 2).

Next, I calculated the lateral suspension stiffness from the yaw tests with spring planks and modified the lateral suspension in the model. Predictions for a 50 mph. run on low-joint track are shown in Figure 3. Note that the car body lateral accelerations decreased from a peak of 0.08 g's with the roll stabilizers to less than 0.04 g's with the spring plank. Adding a hydraulic damper of 400 pound/in./sec. further reduced the accelerations to approximately 0.03 g's peak (Figure 4). I also ran cases at 25 mph to ensure that lowering the natural yaw frequency of the car would not create a problem at this speed, which corresponds to a 0.8 Hz joint frequency. Figures 5 and 6 contain NUCARS predictions for this speed and show that the lateral accelerations are even lower than at 50 mph.

Another concern when replacing the roll stabilizers with spring planks is the potential for larger car body roll displacements due to the "softer" roll suspension. According to the NUCARS model predictions, however, the car body roll angles on the staggered low joint track (0.5 inch cross-level difference) are very low for both suspension configurations. It would be a good idea, however, to proceed with the installation of vertical hydraulic dampers on the Ultradome cars.

As per our telephone conversation today, I have included, in Figure 7, time series and PSD plots for the Westours dome car, Korean car and Ultradome car #83. Note that the Ultradome car was operating at a lower speed than the other cars when the data were recorded.

Please call me at (719) 584-0563 if you have any questions about this letter or the tests. I am anxious to know how the spring plank trucks perform in Alaska.

Sincerely,

Stephen Mace

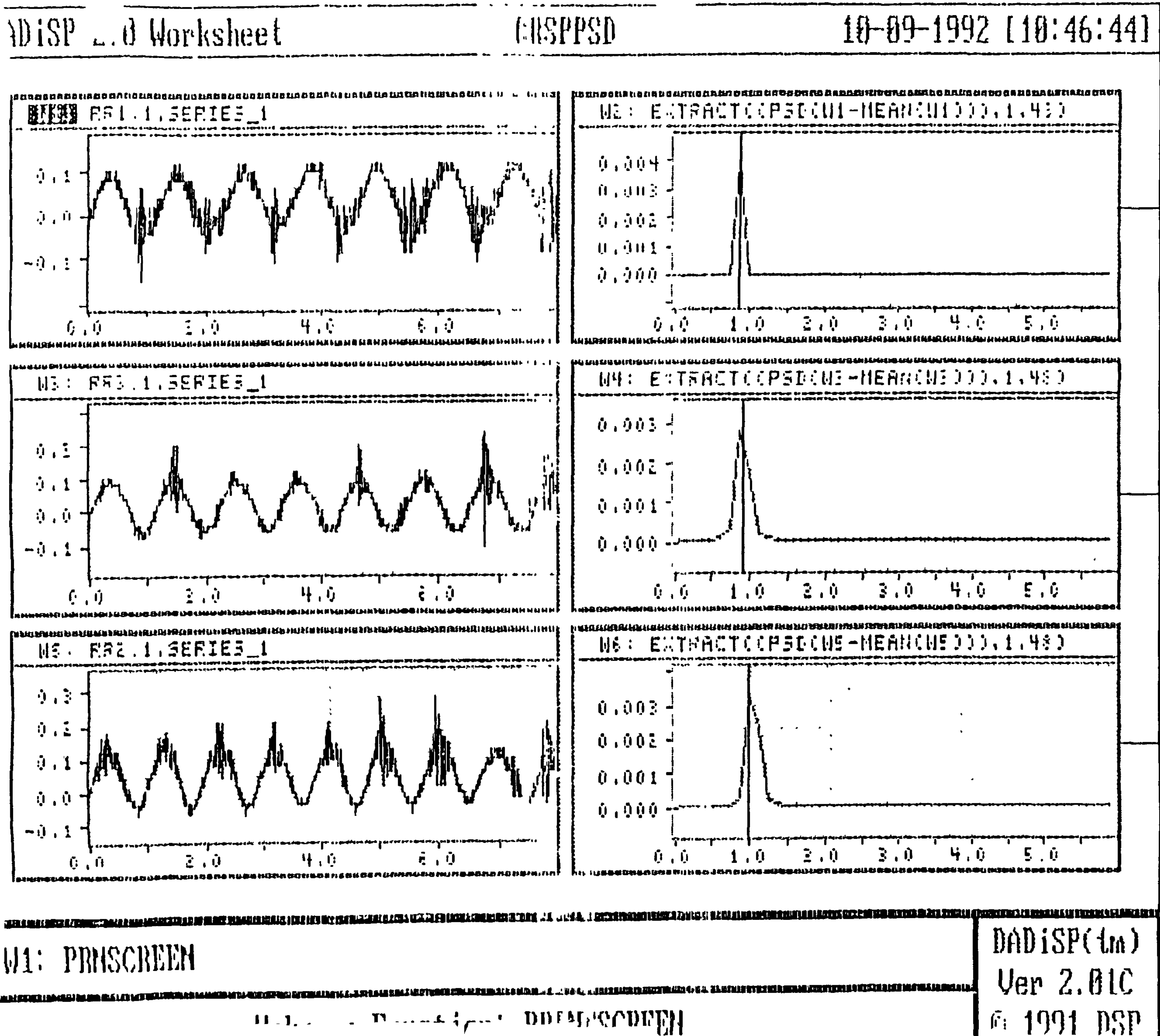
Stephen Mace
Engineer

Enclosures

SEM/amw

cc: M. Dembosky

FIGURE 1

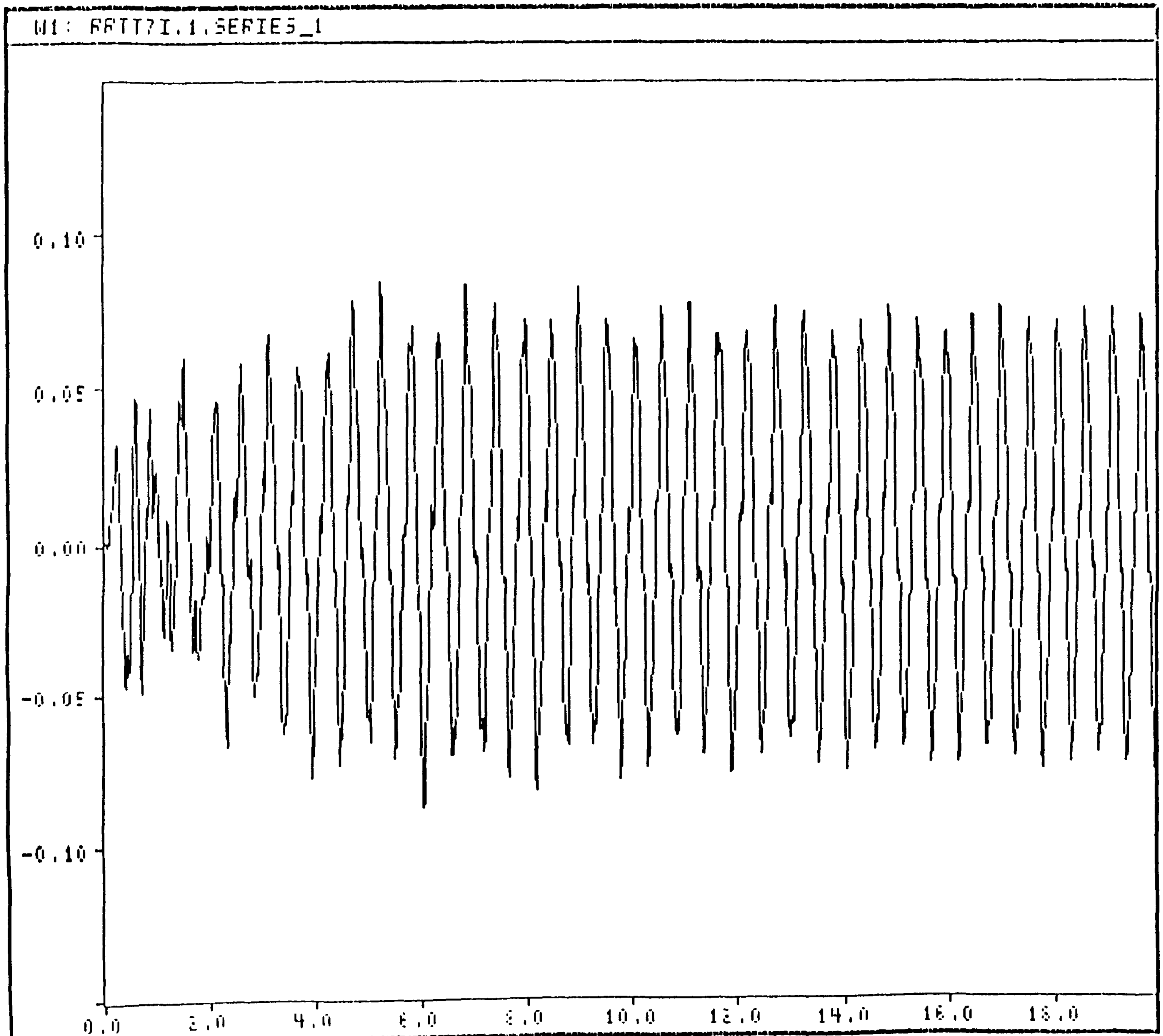


Yaw Frequency
0.8 Hz
No shocks
No bolster rods

Yaw Frequency -
0.9 Hz
Shocks
No bolster rods

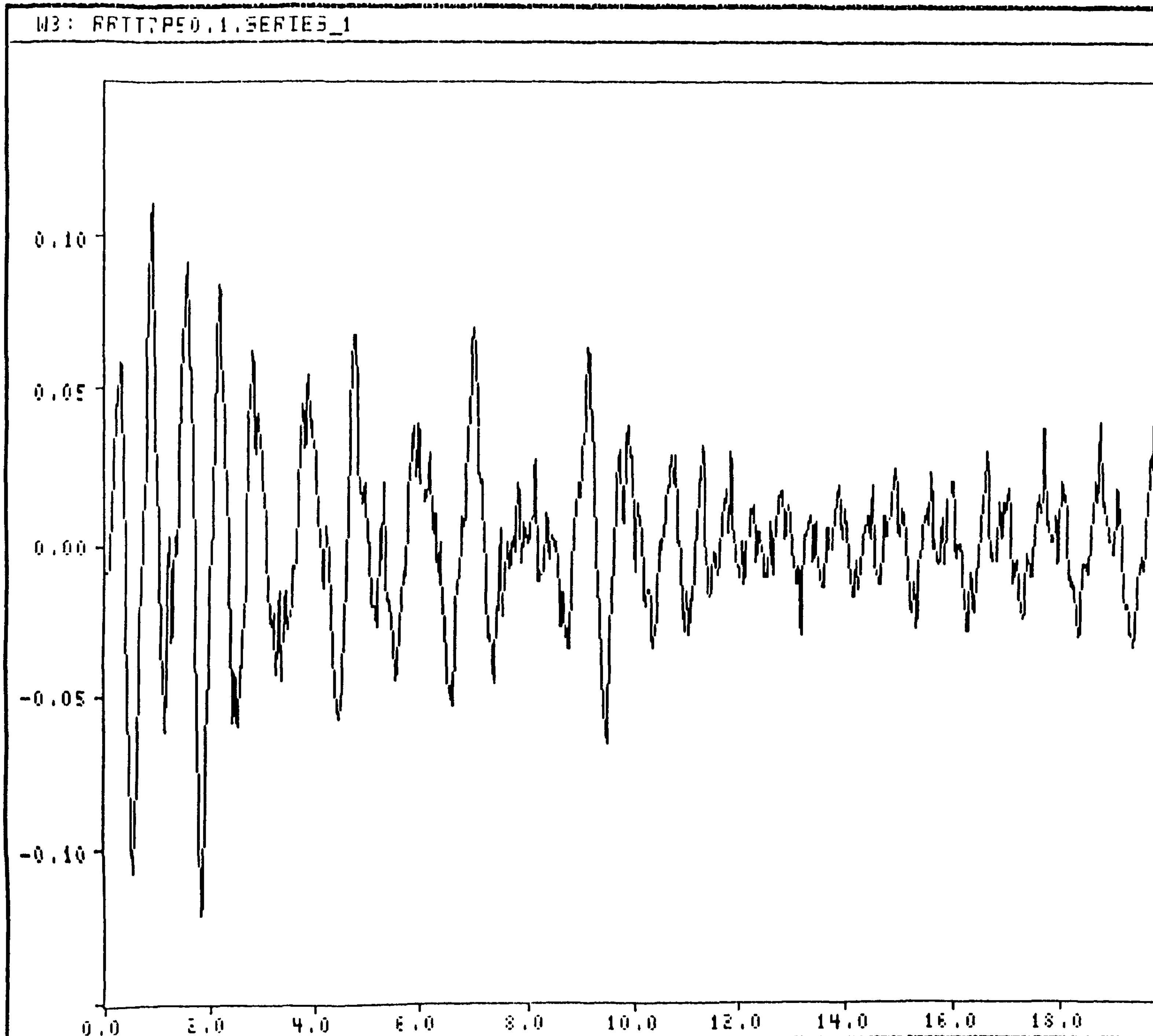
Yaw Frequency -
1.0 Hz
Shocks
Bolster rods

FIGURE 2



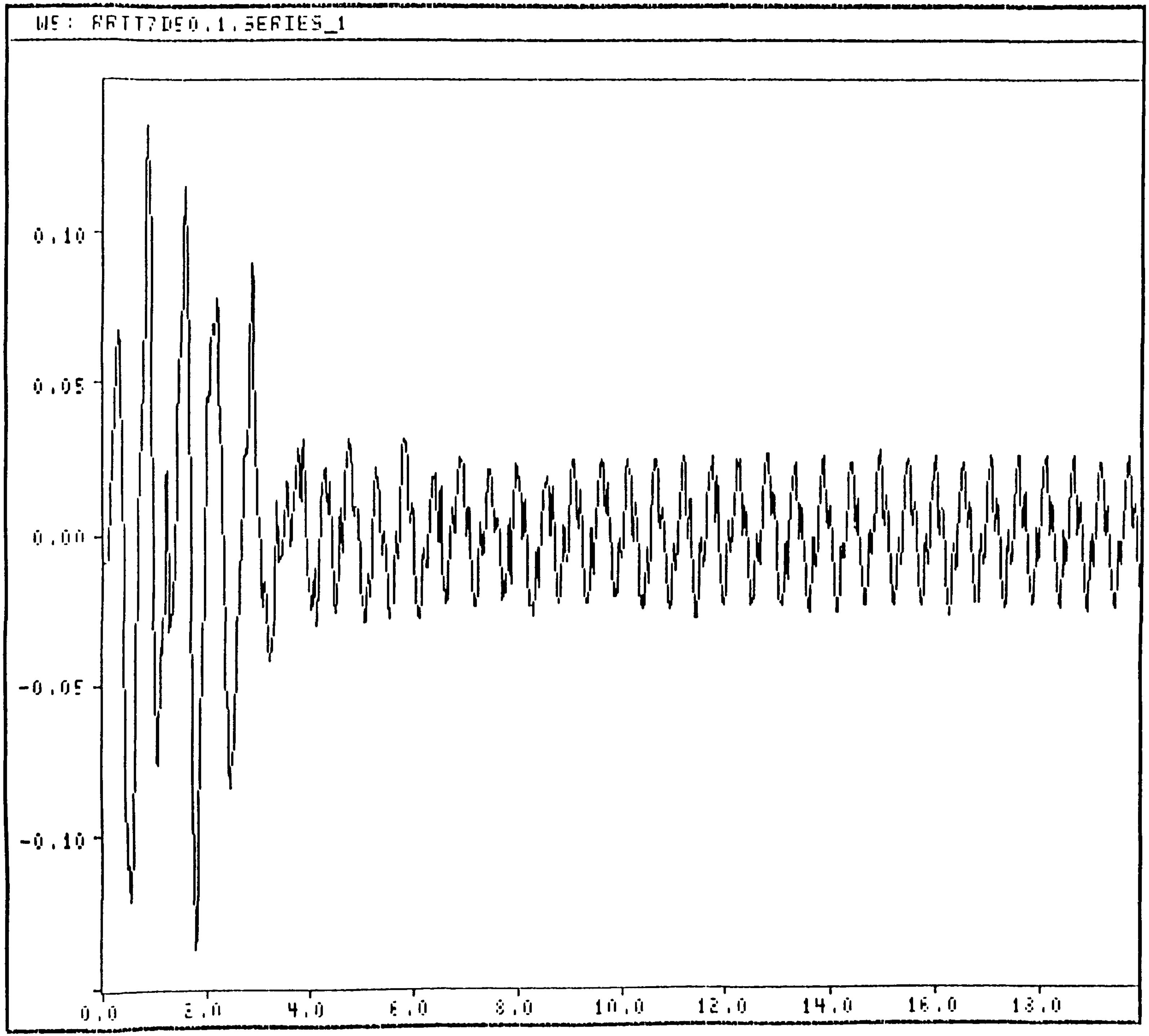
Ultradome Car
NUCARS Predictions
50 mph on jointed track, WITH ROLL STABILIZER

FIGURE 3



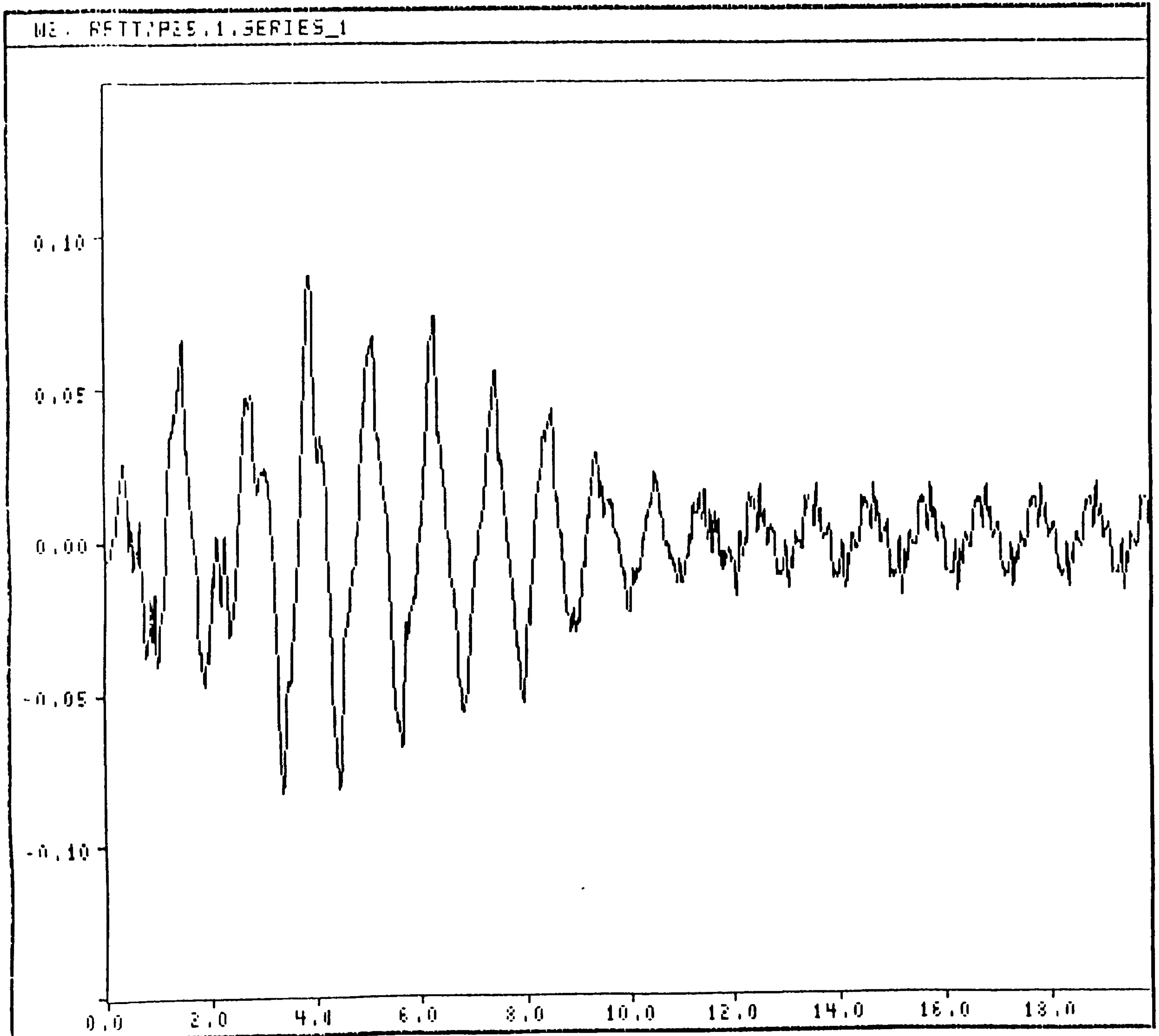
Ultradome Car
NUCARS Predictions
50 mph on jointed
track, WITH SPRING
PLANK

FIGURE 4



Ultradome Car
NUCARS Predictions
50mph on jointed
track, WITH SPRING
PLANK and 400lb/in
LATERAL DAMPER

FIGURE 5



Ultradome Car
NUCARS Predictions
25 mph on jointed
track, WITH SPRING
PLANK

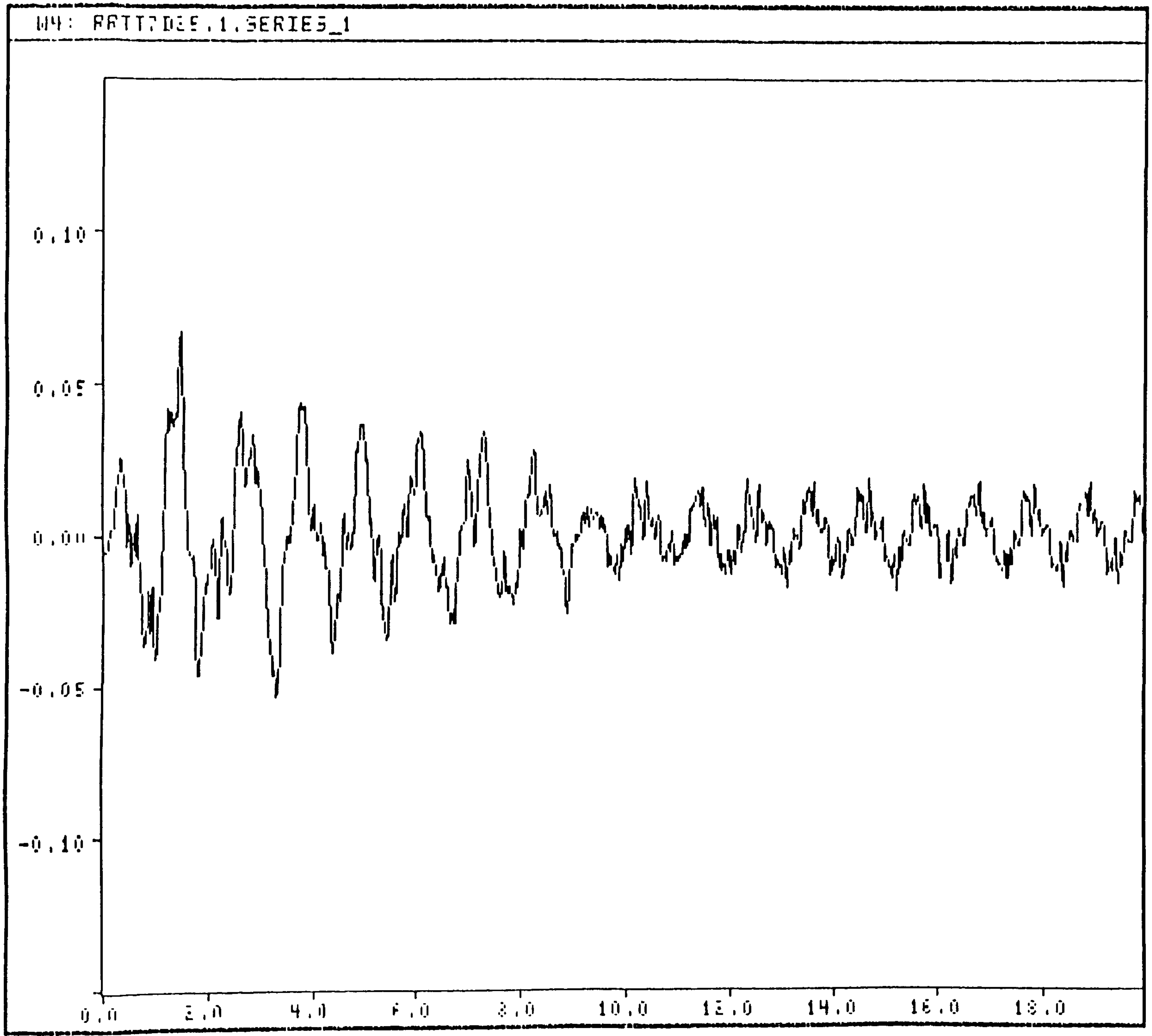
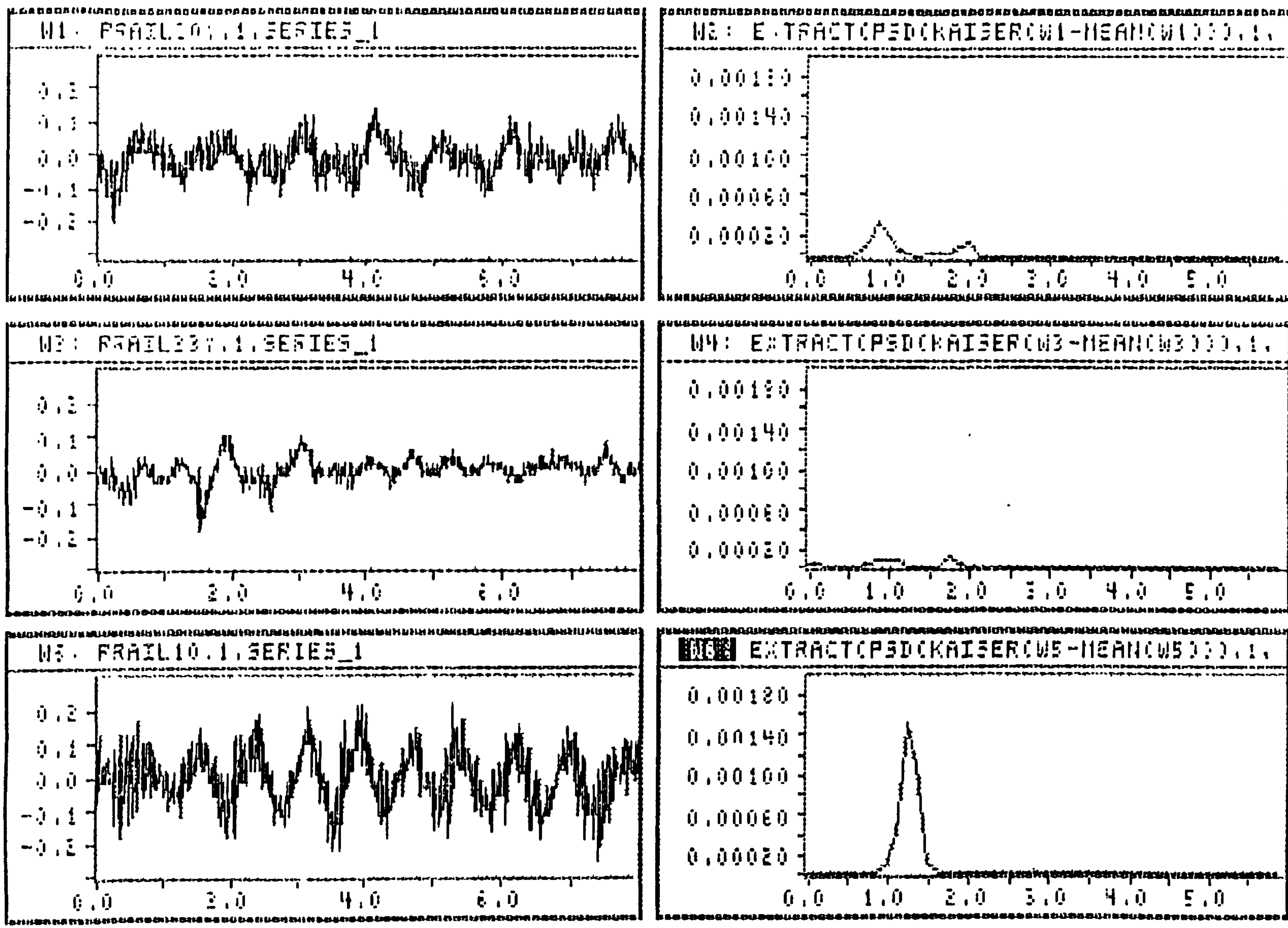


FIGURE 6

Ultradome Car
NUCARS Predictions
25 mph on jointed
track, WITH SPRING
PLANK and 400 lb/in/s
LATERAL DAMPER

DADiSP 2.0 Worksheet RRSPPSD 10-09-1992 [14:41:38]

FIGURE 7



Westours Dome BUD Car #1952 49 mph

ARR Korean Car 49 mph

Ultradome Car "83" w/Snubbers 45 mph

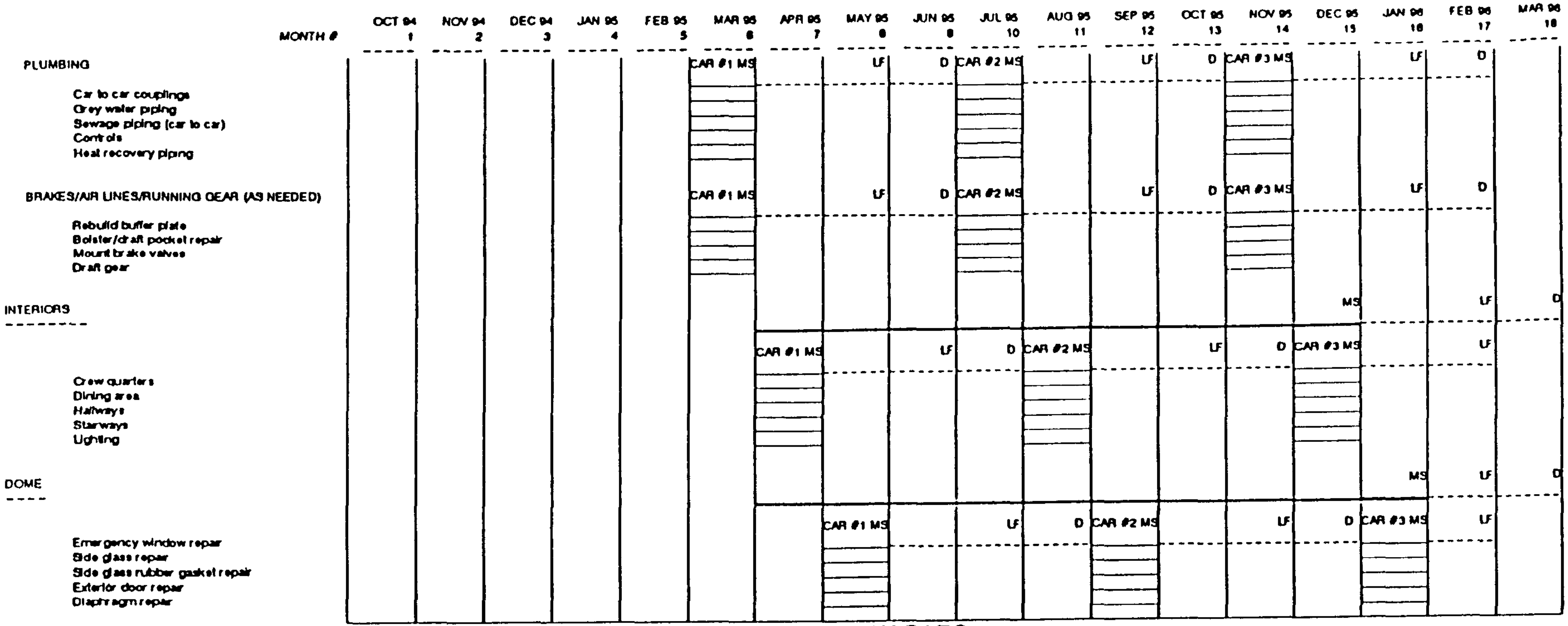
W6: PRNSCREEN

DADiSP(tm) Ver 2.01C © 1991 DSP

SCHEDULE G

ULTRADOME RIDE QUALITY REPORT

This schedule consists of the 27 pages attached hereto.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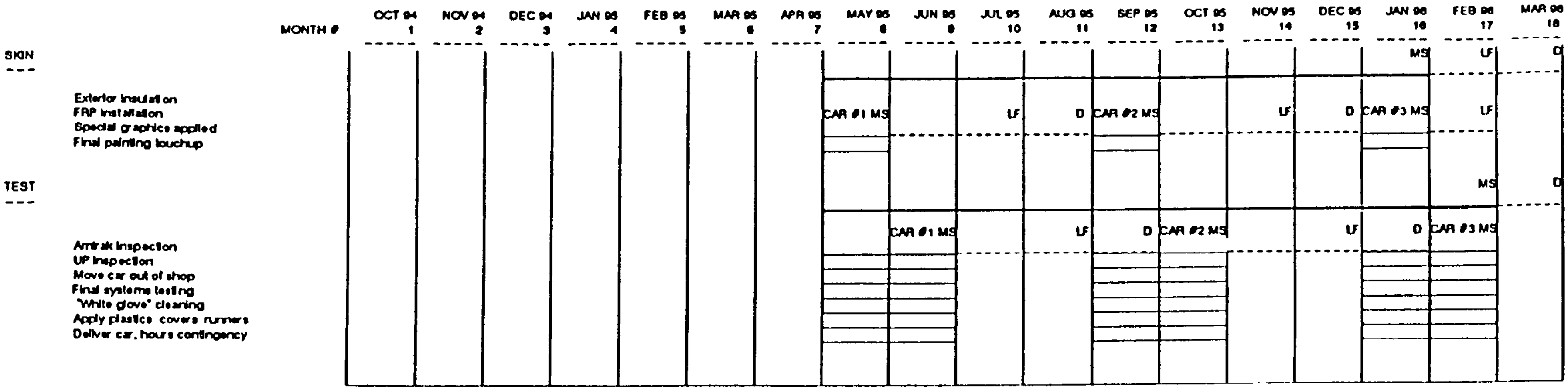
OCT 94 1
NOV 94 2
DEC 94 3
JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PLUMBING
Car to car couplings
Grey water piping
Sewage piping (car to car)
Controls
Heat recovery piping
BRAKES/AIR LINES/RUNNING GEAR (AS NEEDED)
Rebuild buffer plate
Bolster/draft pocket repair
Mount brake valves
Draft gear
INTERIORS
Crew quarters
Dining area
Hallways
Stairways
Lighting
DOME
Emergency window repair
Side glass repair
Side glass rubber gasket repair
Exterior door repair
Diaphragm repair
CAR #1 MS
CAR #2 MS
CAR #3 MS
LF
D
MS

CREW CARS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MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
SKIN
Exterior insulation
FRP installation
Special graphics applied
Final painting touchup
CAR #1 MS
LF
D
CAR #2 MS
LF
D
CAR #3 MS
LF
MS
LF
D
TEST
Amtrak inspection
UP inspection
Move car out of shop
Final systems testing
"White glove" cleaning
Apply plastics covers runners
Deliver car, hours contingency
CAR #1 MS
LF
D
CAR #2 MS
LF
D
CAR #3 MS
MS
D

CREW CARS

	OCT 94	NOV 94	DEC 94	JAN 95	FEB 95	MAR 95	APR 95	MAY 95	JUN 95	JUL 95	AUG 95	SEP 95	OCT 95	NOV 95	DEC 95	JAN 96	FEB 96	MAR 96
MONTH #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

PRODUCTION MILESTONES																		
PER PERIOD																		
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Percent Complete	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CUMULATIVE																		
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LATE FINISHES																		
PER PERIOD																		
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Complete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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DEFAULTS																		
PER PERIOD																		
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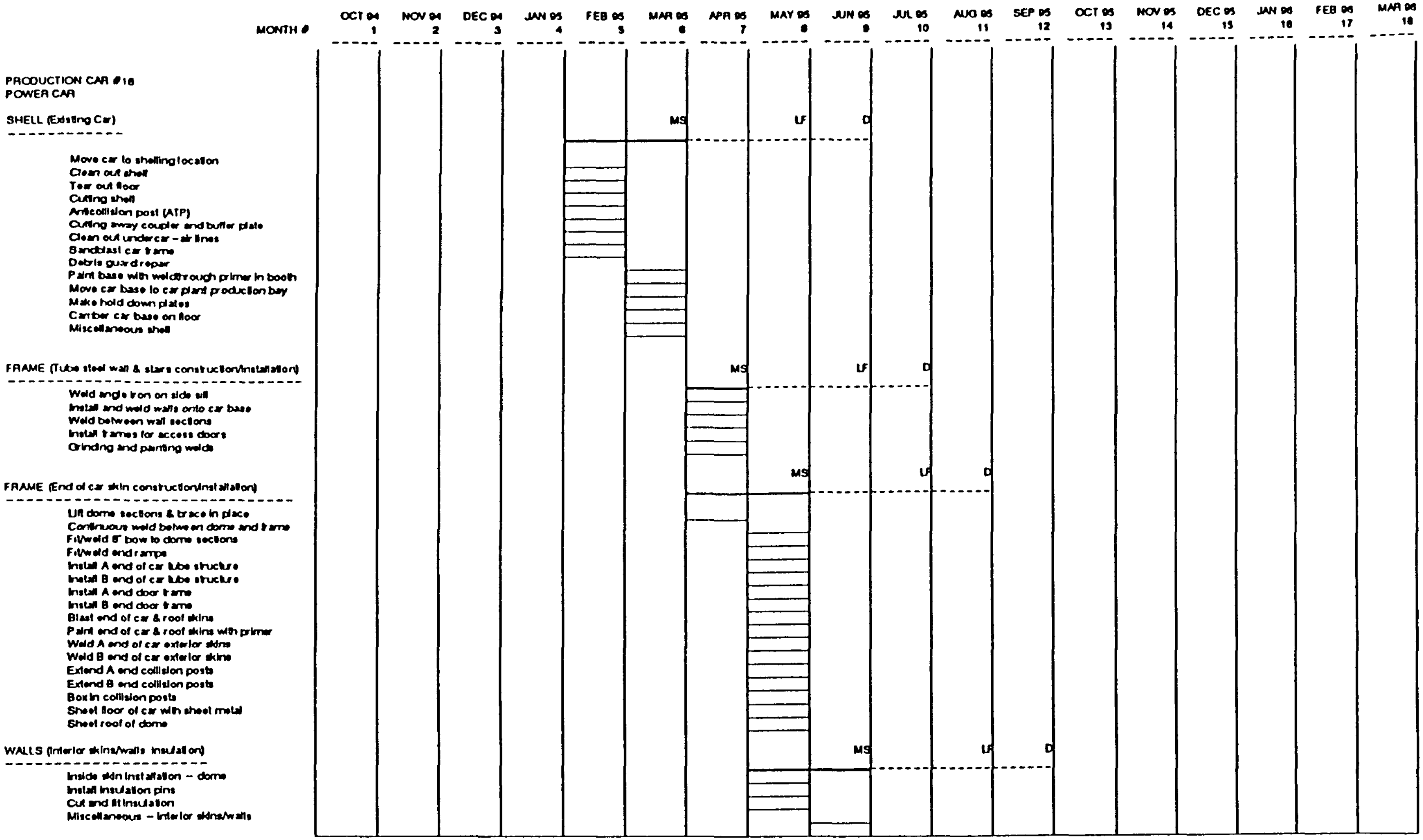
CREW CARS



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JAN 95 4
FEB 95 5
MAR 95 6
APR 95 7
MAY 95 8
JUN 95 9
JUL 95 10
AUG 95 11
SEP 95 12
OCT 95 13
NOV 95 14
DEC 95 15
JAN 96 16
FEB 96 17
MAR 96 18
PRODUCTION CAR #16
POWER CAR
SHELL (Existing Car)
MS
LF
D
Move car to shelling location
Clean out shell
Tear out floor
Cutting shell
Anticollision post (ATP)
Cutting away coupler and buffer plate
Clean out undercar – air lines
Sandblast car frame
Debris guard repair
Paint base with weldthrough primer in booth
Move car base to car plant production bay
Make hold down plates
Camber car base on floor
Miscellaneous shell
FRAME (Tube steel wall & stairs construction/installation)
MS
LF
D
Weld angle iron on side sill
Install and weld walls onto car base
Weld between wall sections
Install frames for access doors
Grinding and painting welds
FRAME (End of car skin construction/installation)
MS
LF
D
Lift dome sections & brace in place
Continuous weld between dome and frame
Fit/weld 8" bow to dome sections
Fit/weld end ramps
Install A end of car tube structure
Install B end of car tube structure
Install A end door frame
Install B end door frame
Blast end of car & roof skins
Paint end of car & roof skins with primer
Weld A end of car exterior skins
Weld B end of car exterior skins
Extend A end collision posts
Extend B end collision posts
Box in collision posts
Sheet floor of car with sheet metal
Sheet roof of dome
WALLS (Interior skins/walls insulation)
MS
LF
D
Inside skin installation – dome
Install insulation pins
Cut and fit insulation
Miscellaneous – interior skins/walls

POWER CAR

ULTRADOME CAR RIDE QUALITY TEST

REPORT NO. P-91-114

by
Stephen E. Mace

Association of American Railroads
Transportation Test Center
Pueblo, Colorado 81001

February 1992

Table of Contents

1.0 INTRODUCTION

Princess Tours operates four Ultradome cars between Anchorage and Fairbanks, Alaska, as part of a combination ship and rail tour. These double deck luxury dome cars exhibit poor ride quality due to excessive lateral vibrations over portions of the tour route. Mr. Thomas Rader of Rader Railcar Inc., which built the Ultradome cars, requested assistance from the Association of American Railroads (AAR), Transportation Test Center (TTC), Pueblo, Colorado, to improve the ride quality of the cars.

The Ultradome cars' ride quality problem has been described as excessive lateral vibration resulting from yawing of the car bodies on tangent track (yaw refers to the motion of the car body when the ends move laterally 180 degrees out of phase). The vibration appears to become most severe at around 50 mph. Poor ride quality on the Ultradome cars has been noticed only on the Alaska tour route. Earlier operations of the Ultradome cars on continuously welded rails revealed no ride quality problem.

The ride quality problem was previously addressed by Mr. Rader with the assistance of General Steel Industries (GSI), who manufactured the trucks used in the Ultradome cars. In June of 1988, GSI personnel installed instrumentation on an Ultradome car and recorded measurements as the car operated over the tour route. Although the results from this study were inconclusive, useful measurements of truck and car body motions were recorded.

TTC proposed to analyze and improve the ride quality of the Ultradome car design through the use of an analytical model of the car developed with the New and Untried Car Analytical Regime Simulator (NUCARS) program. NUCARS is a computer program originally developed to predict the dynamic response of new types of freight cars.

This report describes how the Ultradome car model was developed, validated and modified, and recommends certain suspension modifications to improve the ride quality of the Ultradome cars.

2.0 OBJECTIVES

1. Develop and validate an accurate analytical model of the Ultradome car design with the NUCARS program in conjunction with vehicle characterization tests and detailed design information.
2. Improve the ride quality predicted by the Ultradome car model on tangent track by attempting various suspension modifications.

3. Analyze the effects of the suspension modifications on other operating regimes, especially curve and spiral negotiation.

4. Recommend the suspension modifications which most improve the ride quality without deteriorating performance in other regimes.

3.0 MODELING PROCESS

A base line model of the car was developed with information provided by Rader Railcar, Inc., and data measured by the TTC in several rigid body modal tests. The model was then validated by comparing its critical suspension and car body response predictions to those of a real car.

3.1 NUCARS MODEL DEVELOPMENT

Accurate car and track models were developed with the NUCARS program in the first part of the modeling process.

The Ultradome car model was developed with data from detailed truck and component drawings, car body and truck weight measurements, suspension spring specifications, and rigid body modal tests. In lieu of measuring the actual wheel and rail profiles of the Ultradome cars and Alaska Railroad tracks for use in the model, appropriate profiles were selected from profiles previously measured by the TTC.

The jointed track model development was based on observations and measurements of the Ultradome car ride quality.

3.1.1 Ultradome Car Design and Specifications

Rader Railcar, Inc. supplied the TTC with extensive design data for use in developing the Ultradome car model. These included car body and truck component weights and dimensions, truck assembly drawings and spring specifications.

The Ultradome cars are double deck luxury dome cars fabricated from SP gallery cars. They are equipped with two GSI trucks on 60 foot truck centers. Each car weighs approximately 139,500 pounds fully loaded. The trucks used in the Ultradome cars were manufactured by GSI per arrangement drawing No. 33960. The design features both primary and secondary suspensions, as described below.

The journal boxes of the axles have pockets into which the ends of the equalizer beams fit, providing rigid vertical, lateral, and longitudinal connections between the beams and the journal boxes. The journal boxes also fit inside the pedestal jaws of the truck frame. This arrangement permits relative lateral and longitudinal motion between the journal boxes and the truck frame within the clearances provided by the gibs. Relative vertical motion between the truck frame and journal boxes is essentially unrestrained by this design.

The primary (equalizer) suspension, located between the two equalizer beams and truck frame, consists of eight coil springs. It provides both a vertical and lateral suspension between the equalizer beams (and axles) and the truck frame. Lateral stiffness is provided by shearing the primary springs.

The secondary (bolster) suspension consists of four coil springs between the two truck frame swing hangers and bolster, a pendulum-type suspension provided by the swing hanger, and a roll stabilizer linkage between the swing hangers and bolster. The swing hangers provide a lateral suspension between the bolster and truck frame. The four coil springs function only in the vertical direction, since the roll stabilizer provides the lateral link between the truck frame swing hangers and bolster. The roll stabilizer reduces roll between the truck frame and bolster by equalizing the vertical forces between the two sets of bolster springs.

The bolster connects to the car body through a large central bearing. Two spring-type side bearings are also provided which have approximately 0.25-inch vertical clearance from the car body.

3.1.2 Rigid Body Modal Tests

The rigid or whole body vibration modes of a vehicle are referred to as pitch, bounce, yaw, sway, upper center roll, and lower center roll. The frequency response of the vehicle to excitation in these various modes yields useful information about the suspension characteristics and car body inertias which are used to develop the model.

TTC engineers conducted two rigid body modal tests on a SP gallery car located at the Rader Railcar, Inc. facility in Denver. This car was considered to adequately represent the Ultradome cars since the trucks were identical and the car body mass and center-of-gravity heights were similar. For both tests, the vertical suspension dampers were removed from the trucks to reduce friction in the suspension so that the car could be manually excited. In the first test, the bolster anchors and roll stabilizers were left in place. These were disabled, however, in the second test to simplify the analysis of the suspension.

During both tests, the car was driven in the bounce, pitch, yaw, upper center roll and lower center roll modes by prying with bars across the suspension elements in the trucks. In this way, the forced response of the car body was obtained in the various rigid body modes. The natural car body response was also measured by removing the pry bars after several seconds of forced vibration and allowing the car body to vibrate freely. The car body forced and natural responses were measured with a tri-axial accelerometer box called the Environmental Data Recorder (EDR), manufactured by Instrumented Sensor Technology, Inc.

In the bounce mode test, vertical suspension displacements were produced by prying across the secondary suspension springs in phase at each end of the car. The pitch mode test was similar, but the prying was done with a 180 degrees phase difference between the ends. In both tests, the EDR was placed on the floor at the end of the car and activated to record the vibrations of the car body.

The car was driven in yaw by prying laterally between the truck frame and bolster (across the swing links) with a 180 degrees phase difference between the ends of the car. Prying laterally in-phase at the same locations stimulated the upper center roll of the car. This mode was very difficult to achieve, however, since the car would readily begin to yaw. The EDR was placed on the floor at the end of the car for the yaw mode test and on the floor at the center of the car for the upper center roll mode test.

Lower center roll was easily achieved by prying vertically across the secondary suspension springs of one truck with a 180 degrees phase difference from side to side. The EDR was placed on the shelf in the upper level of the car, where the lateral motion was greatest.

Table 1 lists the frequencies measured for each rigid body mode.

Table 1. Rigid Body Modal Frequencies of the SP Gallery Car

RIGID BODY MODE	TEST NO. 1 FREQUENCY	TEST NO. 2 FREQUENCY
Bounce	2.12	2.12
Pitch	2.50	2.33
Yaw	1.81	1.68
Lower Center Roll	0.68	0.45
Upper Center Roll	2.12	2.12

These frequency values were used in conjunction with the dimensions and masses of the car body and trucks to calculate moments of inertia and the vertical, lateral, roll and yaw suspension stiffnesses of the car.

In general, the measured response frequencies corresponded to those calculated from the design specifications, except for the yaw mode test frequencies of 1.81 Hz and 1.68 Hz. A frequency of approximately 0.7 Hz was calculated for this mode using the characteristics of the truck frame swing hangers. Upon further analysis, it was determined that during the yaw mode test, the forces applied to yaw the car were not of sufficient magnitude to overcome the friction in the swing hanger suspensions. As a result, most of the lateral displacement occurred across the primary (equalizer) springs. Using the characteristics of these springs yielded an expected frequency of 1.6 Hz, much closer to that measured. This result was very significant since the swing hanger suspension friction plays an important role in the ride quality of the Ultradome cars, as discussed in Section 7.

3.1.3 Wheel and Rail Profiles

It is important to use accurate wheel and rail profiles when developing a car model, since the wheel/rail contact geometry has a tremendous effect on the model's performance in many regimes. Unfortunately, it was not practical to measure the actual wheel and rail profiles in Alaska, so the TTC attempted to select a wheel/rail profile combination which would accurately represent those of the Ultradome cars on the Alaska Railroad track.

Discussions with Princess Tours personnel revealed that the wheels of the cars wore quickly in service because of the numerous severe curves in the tour route. A high-conicity worn wheel profile was chosen to represent the wheels of the Ultradome car in the model. This wheel profile, called the Heumann profile, is commonly used to represent worn wheel profiles.

New 136-pound rail profiles were used to represent the rails since the ride quality problem occurred on tangent track where the rails typically experience little wear.

3.1.4 Track Geometry Model Development

As mentioned in the introduction, the ride quality problem of the Ultradome cars appears to have been induced by track joint irregularities, since the cars were reported to have good ride quality on welded rails. The results of the GSI test also indicated that the ride quality problem was related to the track joints.

During the GSI test, lateral suspension displacements peaked at train speeds around 50 mph, which corresponded to a track joint frequency for 39-foot rail sections of about 1.8 Hz. As mentioned in Section 4, the yaw mode frequency of the Ultradome car was also 1.8 Hz. Thus, at 49 mph, the track joints appeared to be driving the car in yaw near its natural frequency. When the train speed changed to 40 or 59 mph during the test, smaller suspension displacements were measured.

This correlation indicated that the track joints were irregular enough to cause the instability. The most common form of joint irregularity is low or dipped joints. For the purposes of modeling the track for NUCARS, the track was given a vertical haversine shape with 0.5 inch "low" joints at the ends of each 39-foot rail section.

3.2 NUCARS MODEL VALIDATION

The Ultradome car model was validated by comparing its predictions for suspension displacements and car body accelerations to those measured in the GSI and Princess Tours tests.

3.2.1 GSI Test Comparison

Model predictions of the journal box to truck frame lateral displacement and bolster to truck frame lateral displacement were compared to actual displacements measured during the GSI test.

Figure 1 contains a time series plot of the lateral displacement between the Ultradome car's No. 3 axle and truck frame measured during the 51 mph GSI test run. The maximum amplitude is approximately 0.8 inches peak-to-peak (p-p) with a frequency of 1.7 Hz. Figure 2 contains a time series plot of the lateral displacement between the model car's No. 2 axle and truck frame for a 50 mph model run. The maximum amplitude is approximately 0.5 inches p-p with a frequency around 1.9 Hz.

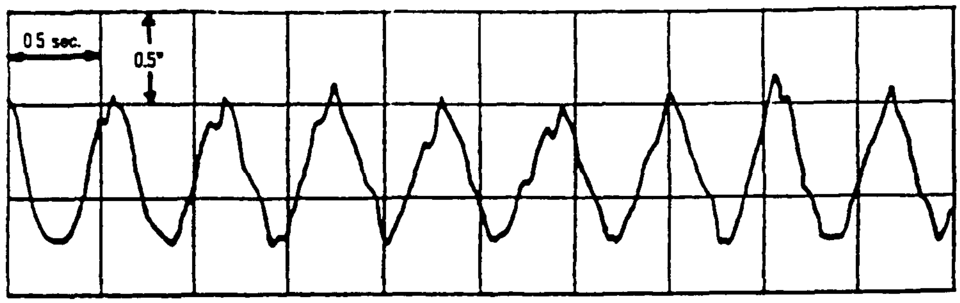

Figure 1. Lateral displacement of the No. 3 axle relative to the truck frame on the Ultradome car tested by GSI.

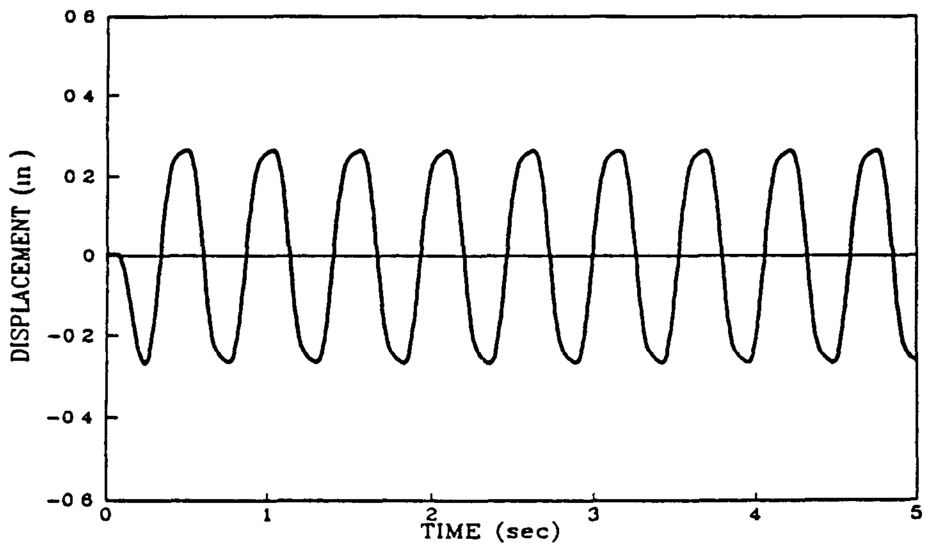

Figure 2. Ultradome model predictions for the lateral displacement of the No. 2 axle relative to the truck frame.

The model predictions closely match the test results in frequency content; however, the predicted displacement amplitudes are somewhat low. It is possible that this amplitude would increase if the actual wheel and rail profiles were used in the model in conjunction with precise track geometry.

Figure 3 contains a time series plot of the lateral displacement between the Ultradome truck frame and bolster measured during the 51 mph GSI test run. The maximum amplitude is approximately 0.6 inches p-p with a frequency around 1.7 Hz. Figure 4 contains a time series plot of the lateral displacement between the model car's No. 2 axle and truck frame for a 50 mph model run. The maximum amplitude is approximately 0.6 inches p-p with a frequency around 1.9 Hz.

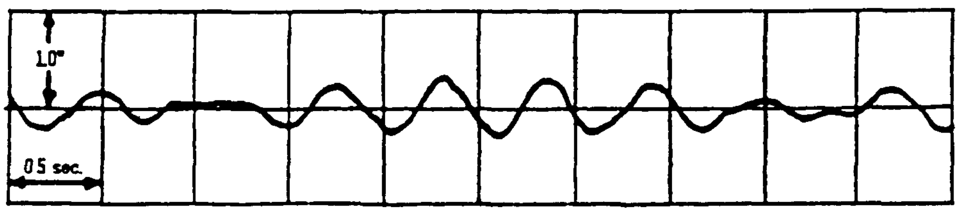

Figure 3. Lateral displacement of the truck frame relative to the bolster on the Ultradome car tested by GSI.

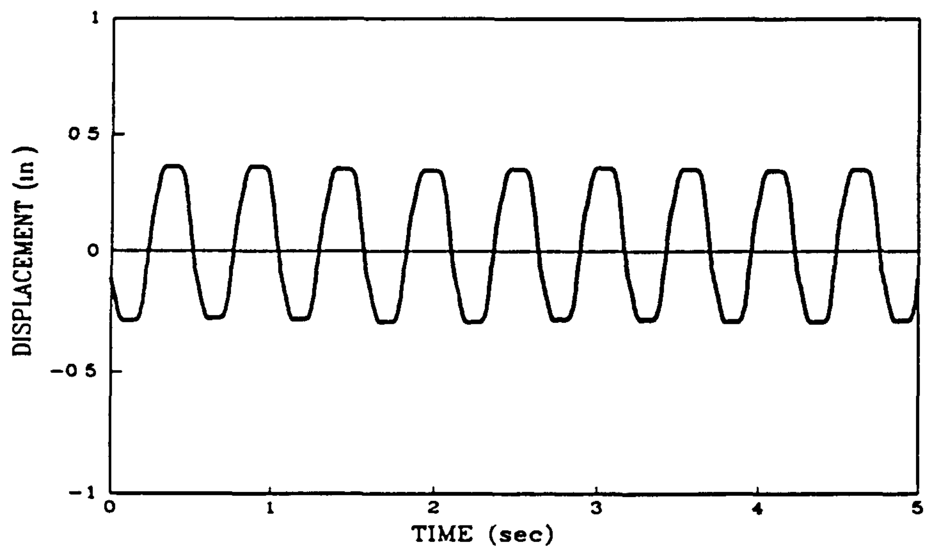

Figure 4. Ultradome model predictions for the lateral displacement of the truck frame relative to the bolster.

3.2.2 Princess Tours Test Comparison

In July of 1991, Princess tours personnel measured the car body and truck accelerations of two Ultradome cars operating over the tour route. Model predictions were compared to these data to help validate the model.

Figure 5 contains a time series plot of the lateral car body acceleration measured with the EDR on the floor of the Ultradome car, No. 82, operating at 45-49 mph on tangent track. Figure 6 contains a time series plot of the lateral car body acceleration predicted by the Ultradome car model operating on tangent track at 50 mph.

Note that the acceleration response predicted by the model appears to be more uniform than the measured response. This is consistent with the idea that the staggered low joints used in the NUCARS model are much more regular than the low joints found in the real track.

Figure 7 contains a PSD plot of the lateral car body acceleration measured with the EDR on the floor of the Ultradome car, No. 82, operating at 45-49 mph on tangent track. Figure 8 contains a PSD plot of the lateral car body acceleration predicted by the Ultradome car model operating on tangent track at 50 mph. The measured and predicted PSD plots are nearly identical in amplitude and frequency.

The comparisons described in this section indicated that an accurate model of the base line Ultradome car had been developed. This base line car model was used to analyze the Ultradome car ride quality problem and to attempt suspension modifications that would improve its ride quality.

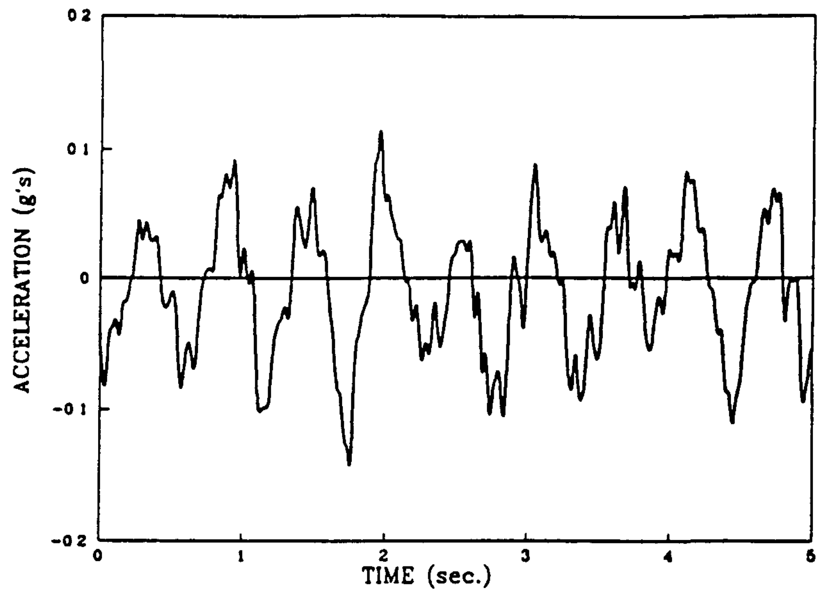

Figure 5. Lateral car body acceleration measured with the EDR on the floor of Ultradome car No. 82.

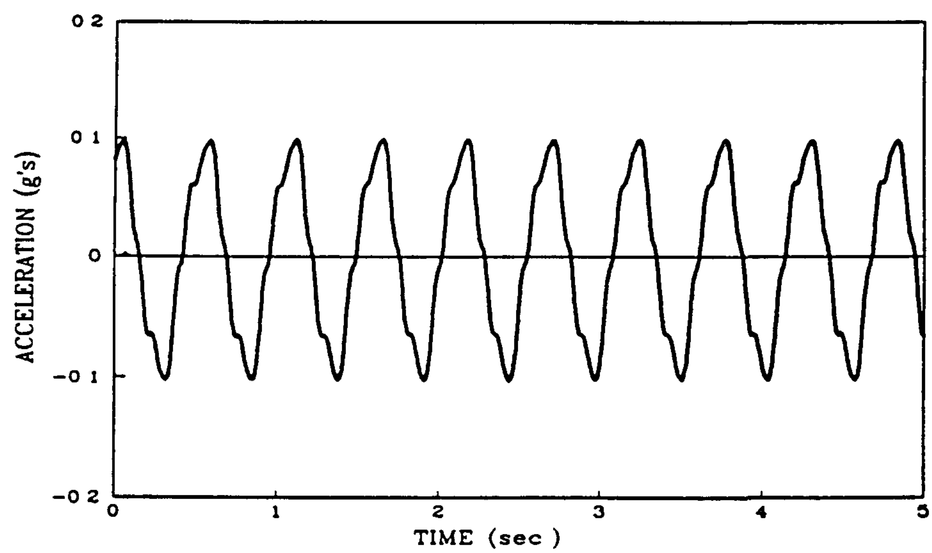

Figure 6. Lateral car body acceleration predicted by the Ultradome car model.

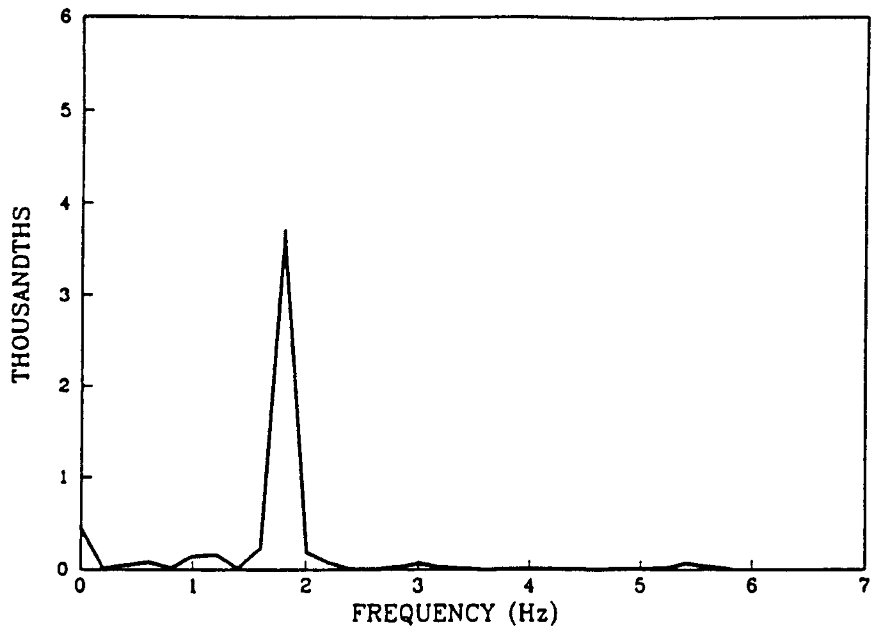

Figure 7. PSD plot of the lateral car body acceleration measured with the EDR on the floor of Ultradome car No. 82.

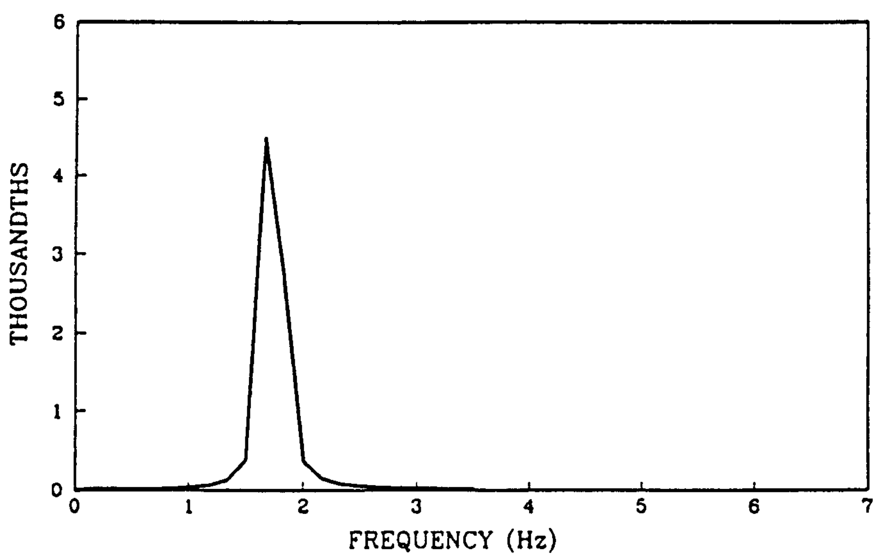

Figure 8. PSD plot of the lateral car body acceleration predicted with the Ultradome car model.

4.0 RIDE QUALITY ANALYSIS AND IMPROVEMENT

The Ultradome's car ride quality was analyzed using both test and model data. This analysis revealed that the ride quality problem resulted from a combination of truck instability and an ineffective secondary lateral suspension.

Both test and model data indicate that the trucks of the Ultradome car become unstable when operating over tracks with staggered low joints at speeds around 50 mph. Lateral vibrations of the unstable trucks are transmitted through the swing hangers to the bolsters and car body. The leading and trailing truck motions are 180 degrees out of phase, driving the car body in yaw vibration. The frequency of this vibration is approximately 1.8 Hz at 50 mph, which corresponds to the natural frequency of the car's yaw mode vibration measured during the modal tests (Section 3.1.2). As a result, the car body exhibits excessive yaw vibration at this speed, which is experienced as poor ride quality by the passengers.

To improve the ride quality, modifications were made to the car model swing hanger suspension. These included reducing the swing hanger suspension friction and adding a viscous damper to the suspension. The journal box lateral clearances and truck roll stabilizer were also modified. Predicted ride quality for the modified car model and the measured ride quality of the real car were compared to the International Organization for Standardization (ISO) reduced comfort boundaries for passengers.

4.1 SWING HANGER SUSPENSION ANALYSIS

The most obvious method of improving the ride quality of the Ultradome cars consists of lowering the yaw mode natural frequency by changing the secondary lateral suspension (swing hanger) characteristics. The natural frequency of vibration for the swing hangers, in the absence of friction, is approximately 0.7 Hz, based on their length of 18 inches. Friction in the pin bearings connecting the swing hangers and truck frames, however, raises the suspension's natural frequency to approximately 1.8 Hz. Thus the natural frequency of the swing hanger suspensions can be lowered by reducing friction in the pin bearings.

Model predictions were used to demonstrate the effect of swing hanger suspension friction on the car's ride quality. Four levels of friction were modeled, ranging from "dry" steel-on-steel to no friction. The friction in the "dry" swing hanger pin bearings was calculated using an estimated friction coefficient of 0.5, which resulted in 2400 pounds of friction per truck. Models were also developed with friction coefficients of 0.25 (1200 pounds of friction), 0.125 (600 pounds of friction), and no friction.

Predictions were made of the car's yaw mode natural frequency by applying a swept sinusoidal force to the axles of each model car and measuring the yaw response of the car body. Figures 9-12 contain PSD plots of the car body yaw displacement predicted by the four models with different swing hanger suspensions. Each plot peaks at the car's natural frequency in yaw. Note that the natural frequency decreases from approximately 1.7 Hz for the dry pin bearing suspension to 1.2 Hz for the suspension with no friction. As expected, reducing friction in the swing hanger pin bearings lowered the model car's yaw mode natural frequency.

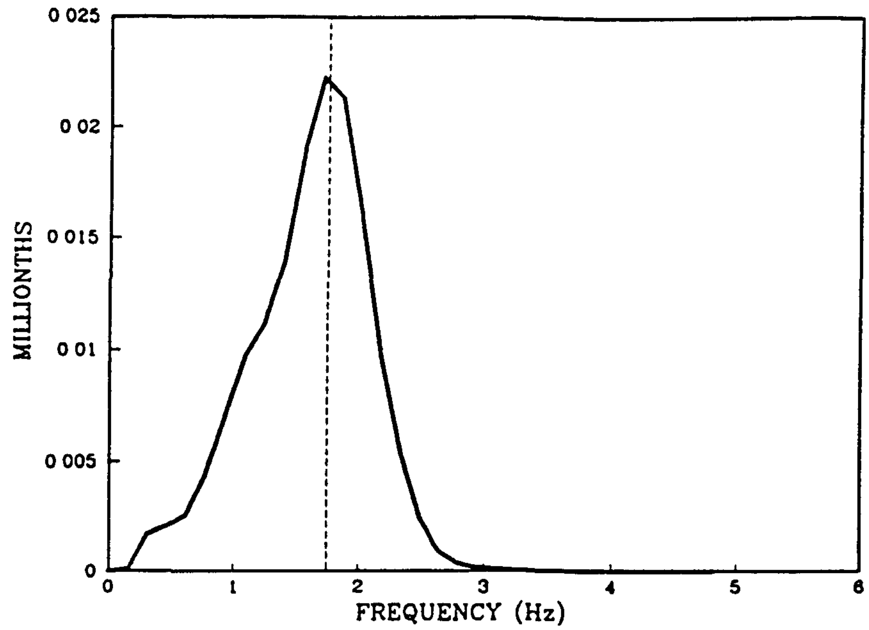

Figure 9. PSD plot of model predictions for the car body yaw response using a swing hanger suspension with 2400 pounds of friction.

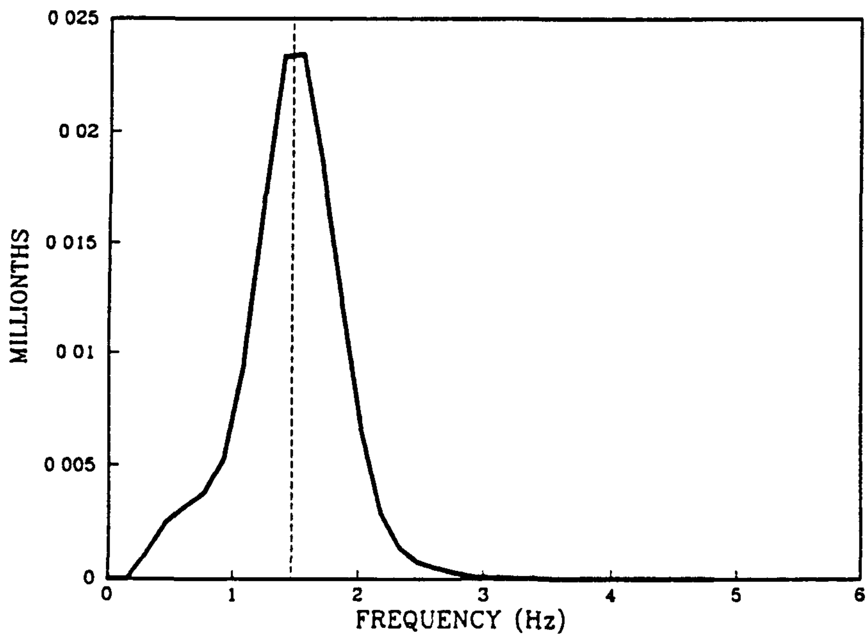

Figure 10. PSD plot of model predictions for the car body yaw response using a swing hanger suspension with 1200 pounds of friction.

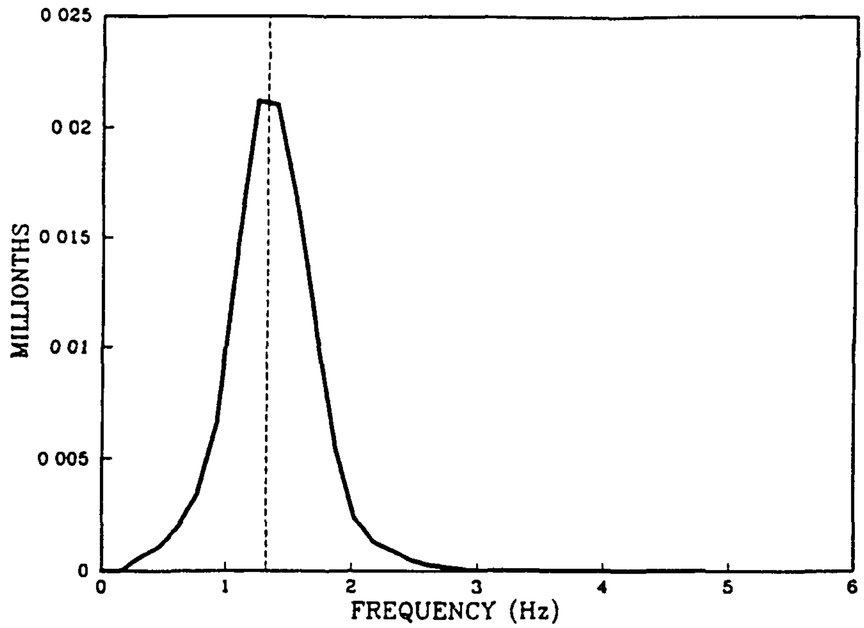

Figure 11. PSD plot of model predictions for the car body yaw response using a swing hanger suspension with 600 pounds of friction.

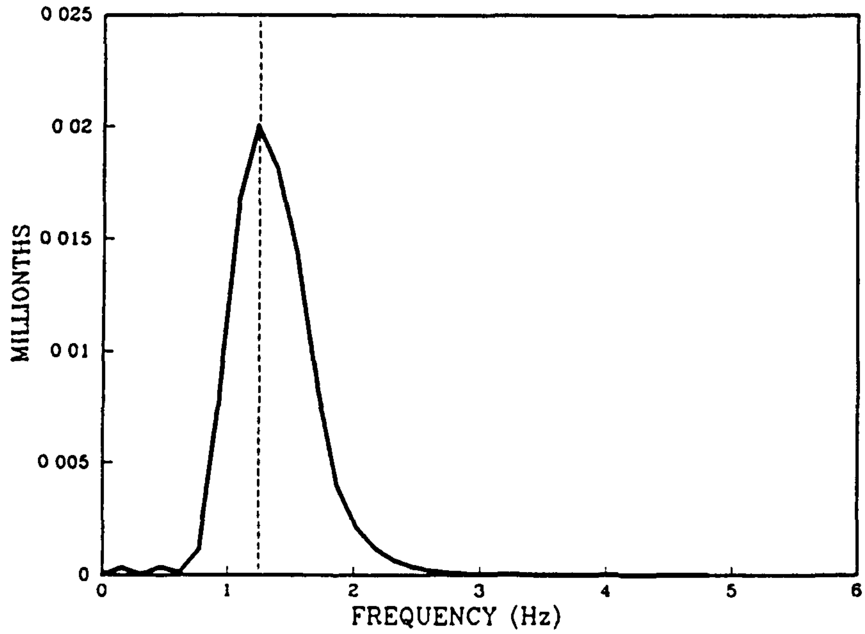

Figure 12. PSD plot of model predictions for the car body yaw response using a swing hanger suspension with no friction.

Lowering the car's yaw mode natural frequency was expected to improve the ride quality of the model car. In order to verify this, car models with swing hanger friction values of 2400, 1200 and 600 pounds were operated over tracks with staggered low joints at 50 mph. Figures 13-15 contain plots of the model predictions for the leading-end car body lateral acceleration. The amplitude of the predicted lateral accelerations decreased by 70 percent, from 0.1 g's, for the "dry" swing hanger suspension, to 0.03 g's for the model with 600 pounds of friction in the swing hangers. These results represent a significant improvement in ride quality.

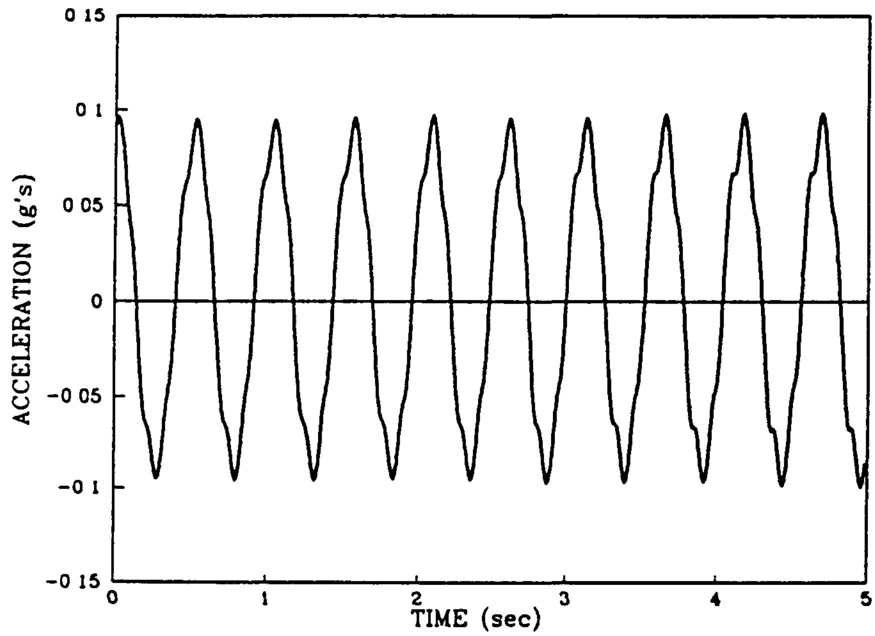

Figure 13. Ultradome car model predictions for lateral car body acceleration using a swing hanger suspension with 2400 pounds of friction.

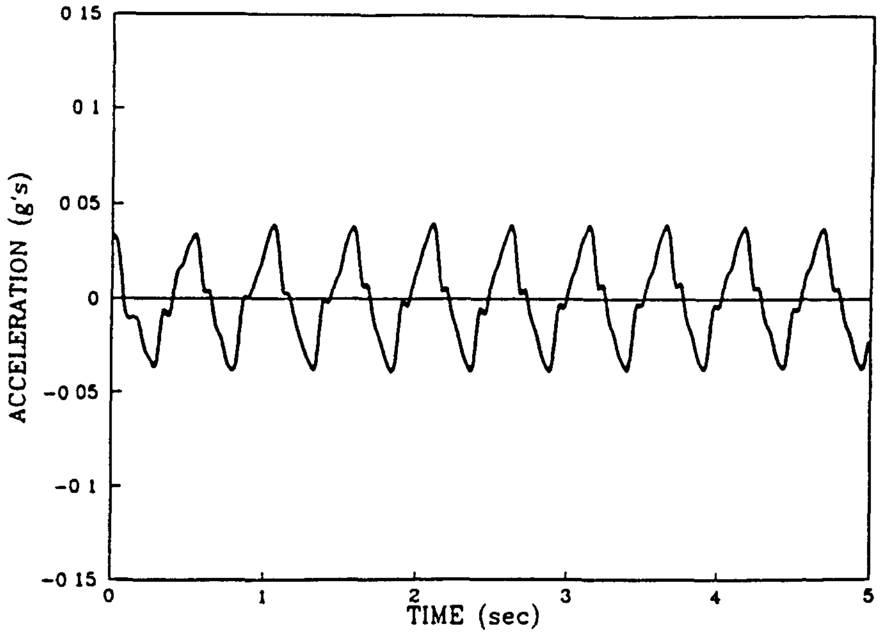

Figure 14. Ultradome car model predictions for lateral car body acceleration using a swing hanger suspension with 1200 pounds of friction.

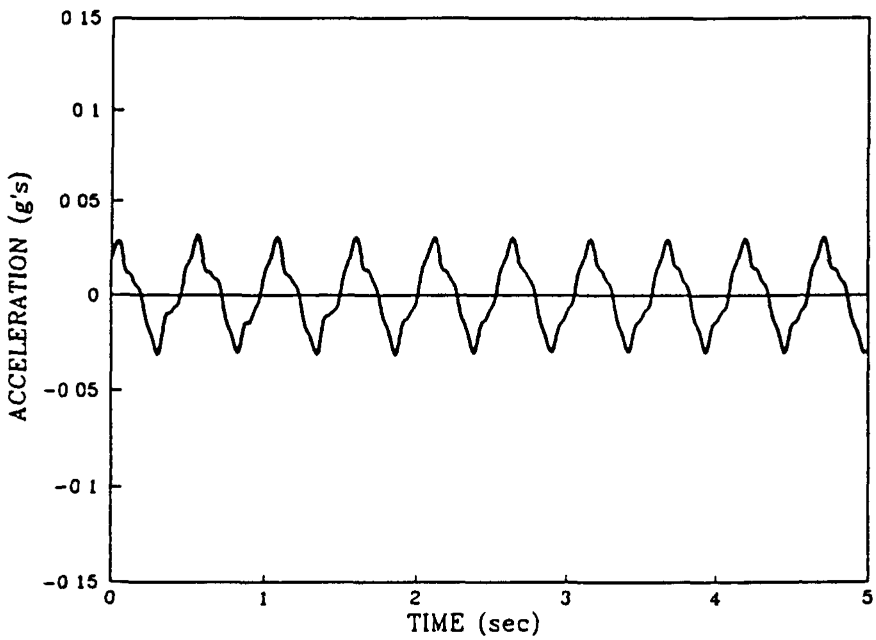

Figure 15. Ultradome car model predictions for lateral car body acceleration using a swing hanger suspension with 600 pounds of friction.

4.2 SWING HANGER SUSPENSION DAMPER

In order to further reduce the lateral vibrations of the car body, viscous dampers were added to the Ultradome car models' swing hanger suspensions. The ideal damping value was estimated by calculating 25 to 30 percent of the critical damping value for the suspension, a technique which generally yields the optimum amount of damping for a passenger vehicle suspension. The optimum amount of damping was found to be approximately 400 lbs/in/sec. This value matched the characteristic of a damper commonly used in the lateral suspensions of locomotive trucks. The rubber mounting bushing stiffness of the locomotive damper (7950 lbs/in) was also used in the model.

Three different dampers were applied to the Ultradome car model to verify that the damping value of 400 lbs/in/sec provides the optimum amount of damping for this suspension. The characteristics of each damper are listed in Table 2. Model runs were conducted at 50 mph over tracks with staggered low joints using the Ultradome car model with 600 pounds of friction in the swing hanger suspensions.

Table 2. Lateral Damper Characteristics - Configuration 1

Damper No.	Damping (lbs/in/sec)	Swing Hanger Friction (pounds)
1	100	600
2	400	600
3	800	600

Figures 16-18 contain plots of the car body lateral accelerations predicted by the Ultradome car models equipped with the three dampers. The amplitude of the lateral car body accelerations predicted by each model were nearly the same. This result was not expected, since the viscous damping varied considerably between the three models, and indicates that **the 600 pounds of friction remaining in the model's swing hangers dominated the damping in the suspension.**

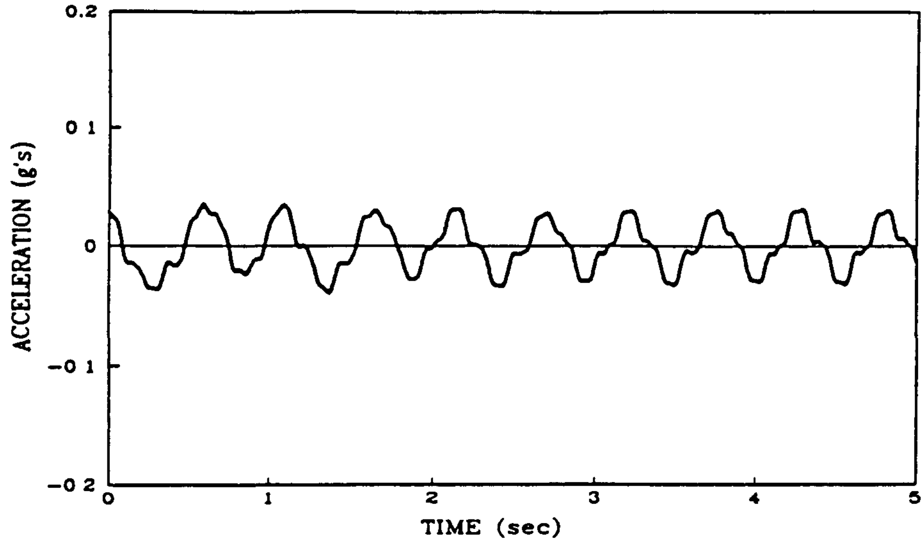

Figure 16. Ultradome car model predictions for lateral car body acceleration using 600 pounds swing hanger friction and Damper 1.

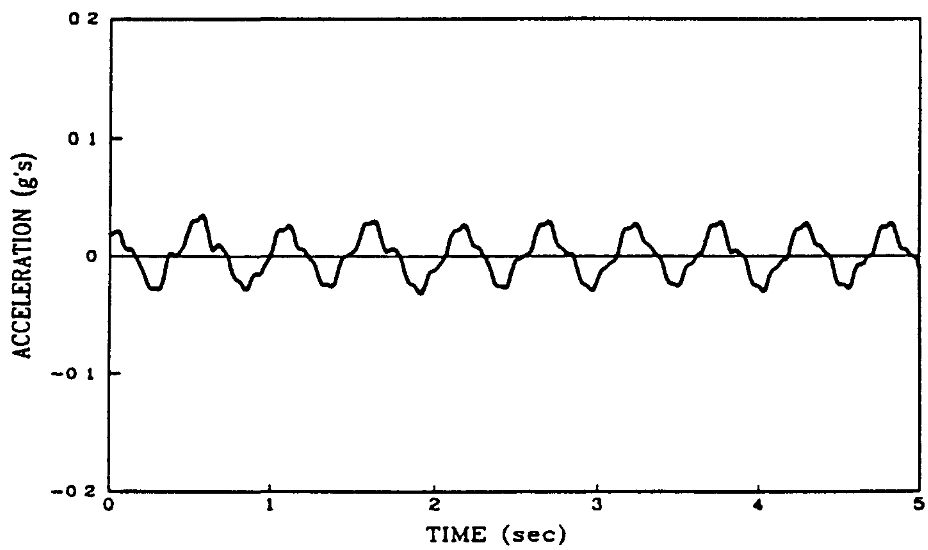

Figure 17. Ultradome car model predictions for lateral car body acceleration using 600 pounds swing hanger friction and Damper 2.

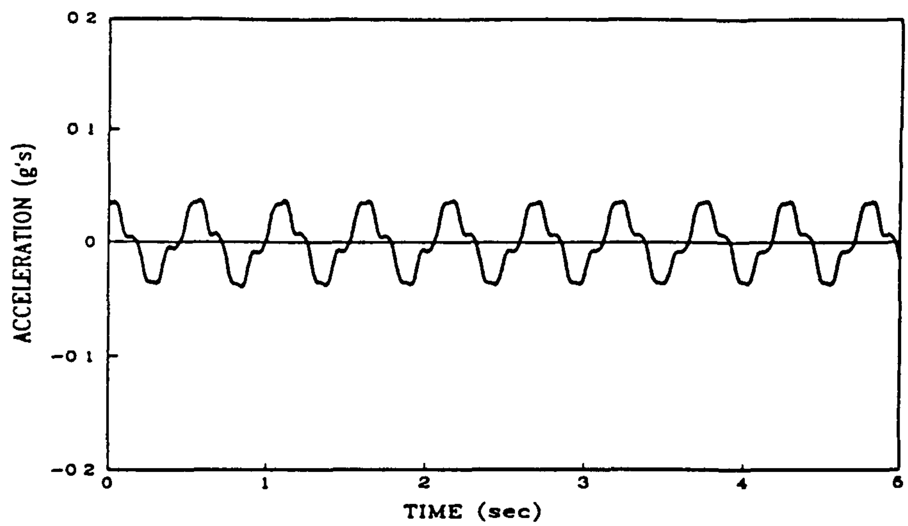

Figure 18. Ultradome car model predictions for lateral car body acceleration using 600 pounds swing hanger friction and Damper 3.

Another attempt was made to verify that the 400 lbs/in/sec damping value represented the optimum for this suspension. This time, a series of models were constructed with **no swing hanger suspension friction** and five different viscous lateral dampers, which are listed in Table 3. Model runs were conducted at 50 mph on tangent track with staggered low joints.

Table 3. Lateral Damper Characteristics - Configuration 2

Damper No.	Damping (lbs/in/sec)	Swing Hanger Friction (pounds)
1	100	0
2	200	0
3	400	0
4	600	0
5	800	0

Figures 19-23 contain plots of the car body lateral accelerations predicted by the Ultradome car model equipped with the five dampers. These results show that increasing the damping value from 200 to 400 lbs/in/sec dramatically reduces the level of car body lateral acceleration. Increasing the damping value above 400 lbs/in/sec did not further reduce the predicted acceleration levels. These results indicate that a damper with 400 lbs/in/sec of damping (Damper 3) provides the optimum damping for the "frictionless" swing hanger suspension.

In practice, however, reducing the swing hanger friction to less than 600 pounds per truck may not be possible. If this proves to be true, **the model results indicate that adding a viscous damper to the Ultradome cars' swing hanger suspensions will not improve their ride quality.**

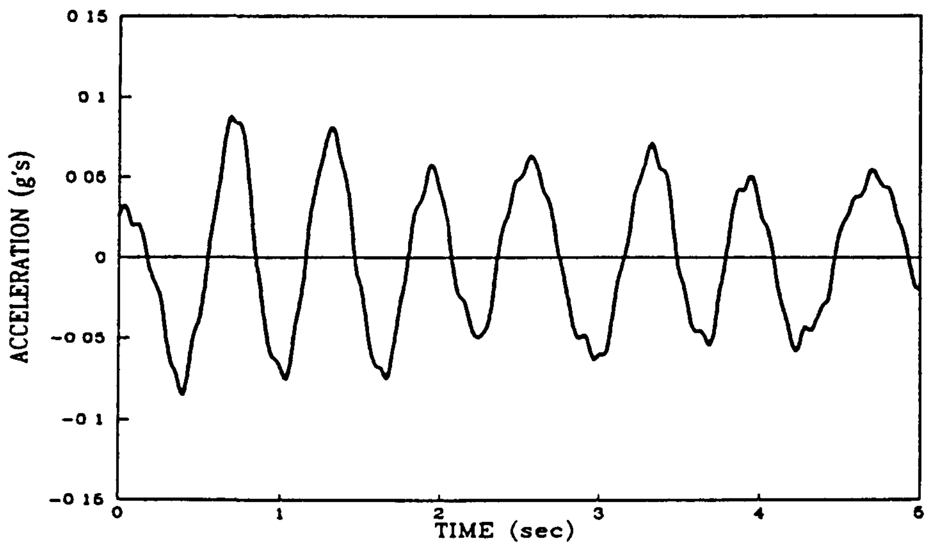

Figure 19. Ultradome car model predictions for lateral car body acceleration using no hanger friction and Damper 1.

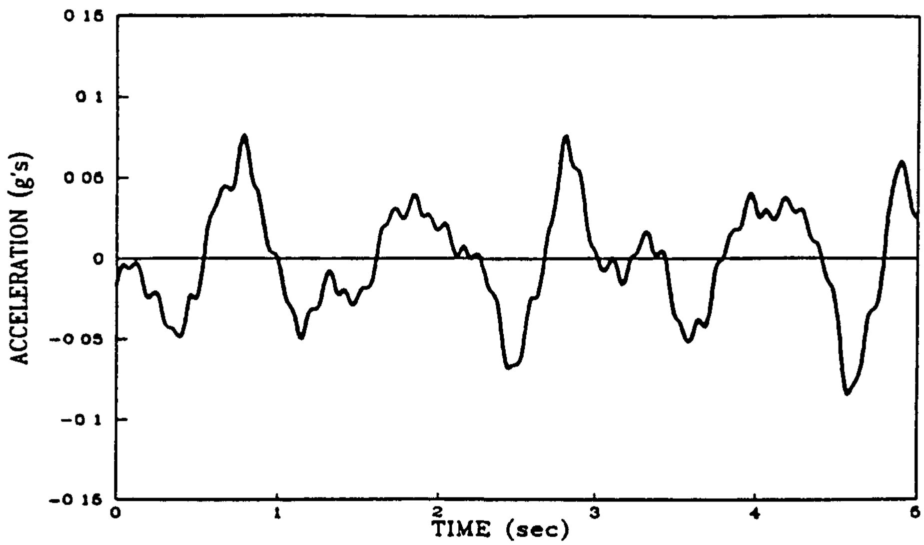

Figure 20. Ultradome car model predictions for lateral car body acceleration using no swing hanger friction and Damper 2.

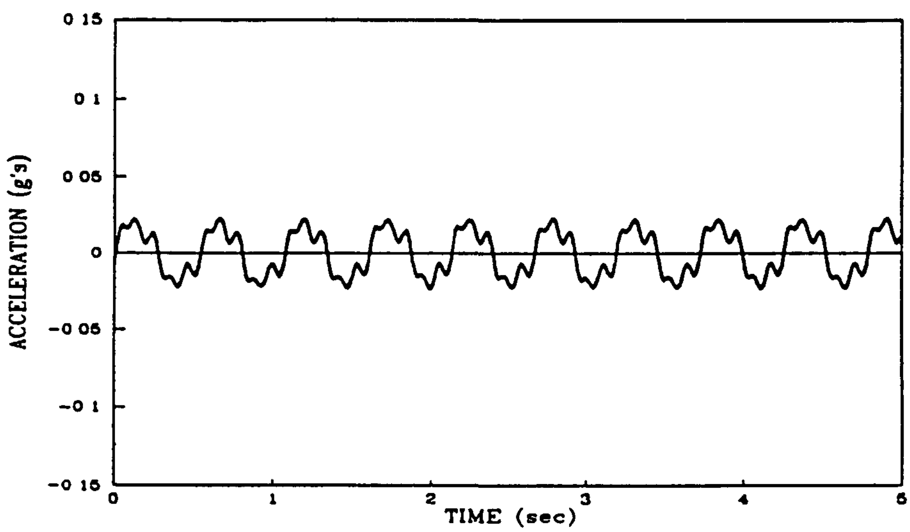

Figure 21. Ultradome car model predictions for lateral car body acceleration using no swing hanger friction and Damper 3.

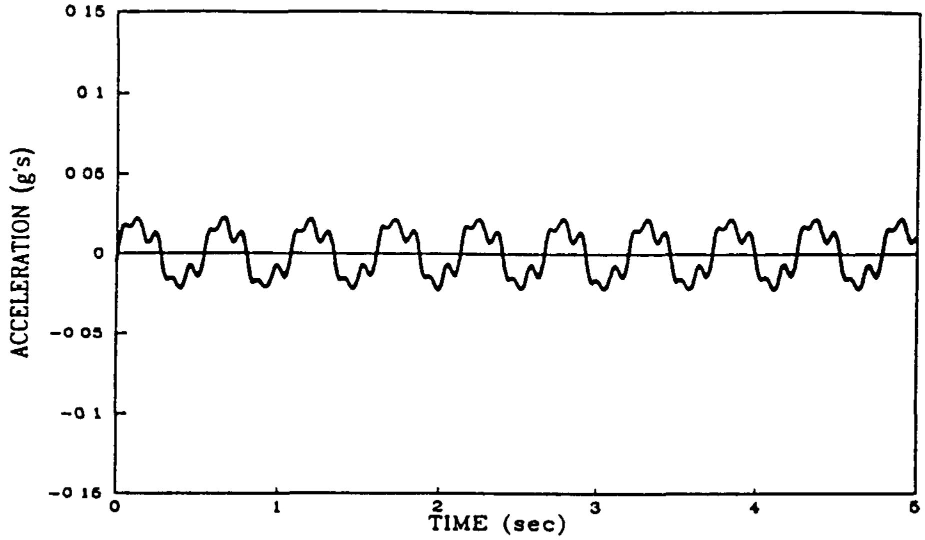

Figure 22. Ultradome car model predictions for lateral car body acceleration using no swing hanger friction and Damper 4.

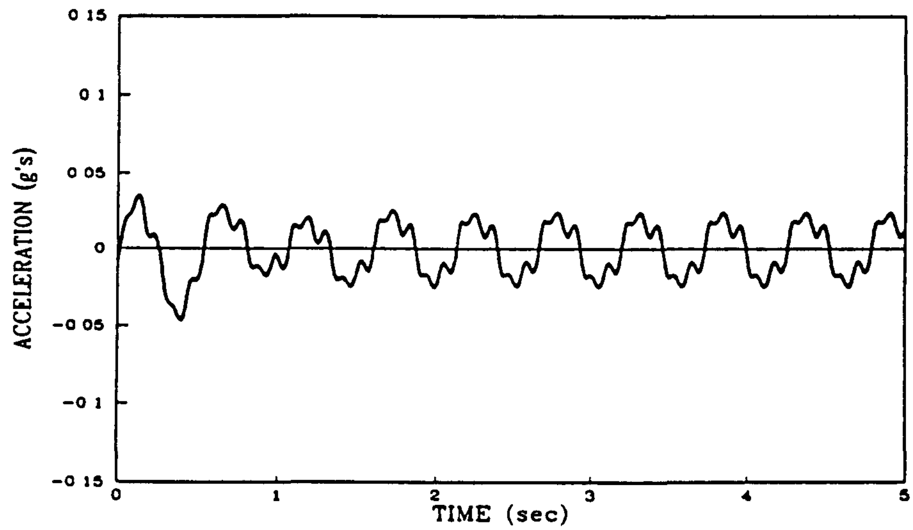

Figure 23. Ultradome car model predictions for lateral car body acceleration using no swing hanger friction and Damper 5.

4.3 OTHER MODIFICATIONS

In addition to the modifications discussed above, two other modifications were attempted with the Ultradome car model. These consisted of reducing the clearances between the journal boxes and truck frame pedestals and removing the roll stabilizer from the suspension. Neither of these modifications improved the lateral ride quality predicted by the car model.

4.4 ISO RIDE QUALITY EVALUATION

The measured and predicted car body accelerations of the Ultradome car were evaluated according to the ISO Guide for the Evaluation of Human Exposure to Whole-Body Vibration, ISO 2631-1978 (E). This guide defines limits or boundaries for the following three human vibration criteria.

1. Fatigue -- decreased proficiency boundary
2. Exposure limit
3. Reduced comfort boundary

The reduced comfort boundary criteria are generally used for ride quality evaluations where passenger comfort is of primary concern.

Figure 24 is a plot that contains the reduced comfort boundaries established by ISO 2631-1978 (E) for vibrations in the vertical and lateral directions. The measured and predicted root-mean-square acceleration levels for the Ultradome car operating at 50 mph are plotted at 1.8-1.9 Hz. According to these criteria, passengers on the Ultradome cars will immediately experience reduced comfort from lateral vibrations. The improved ride quality predicted for the Ultradome car with the swing hanger friction reduced to 600 pounds would allow the passengers to ride for over 2 hours before experiencing reduced comfort from lateral vibrations. Finally, the ride quality of the Ultradome car with no swing hanger friction and equipped with a 400 lbs/in/sec lateral damper would provide a comfortable ride for over 3 hours.

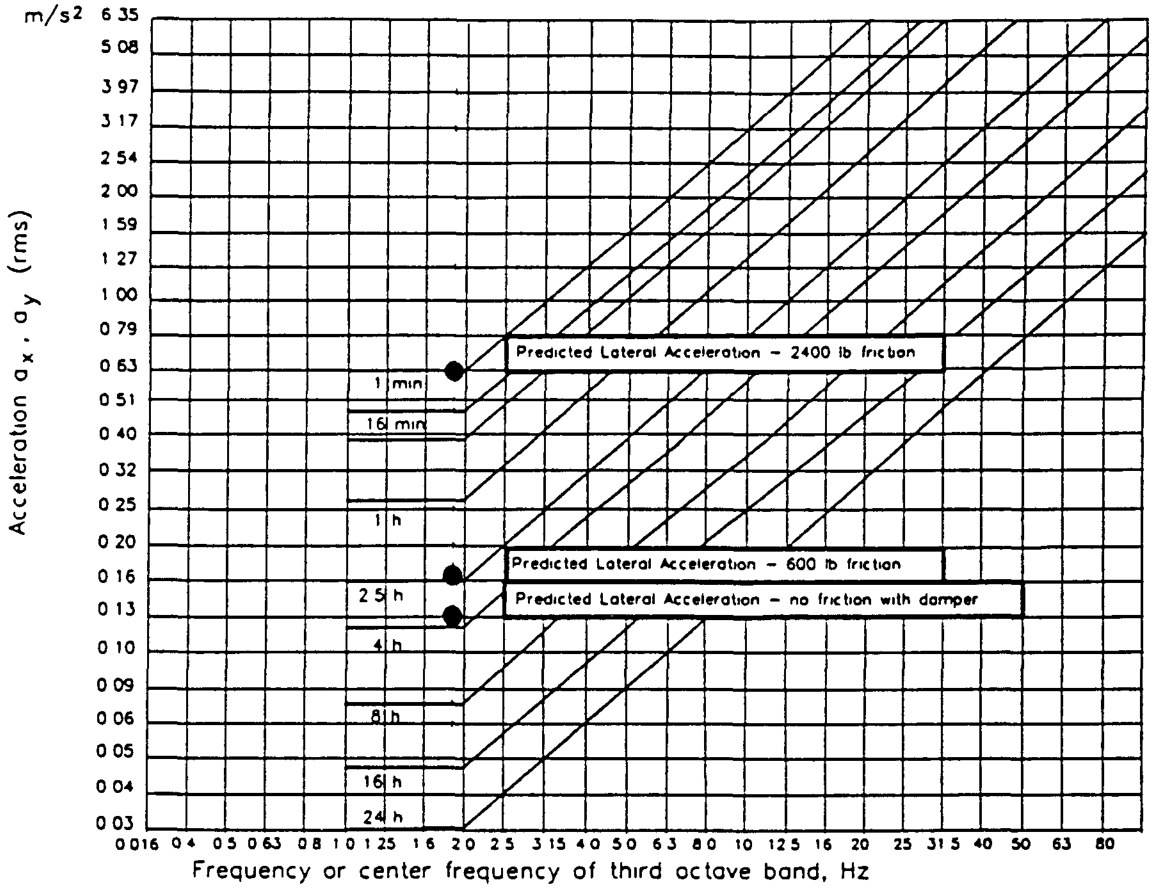

Figure 24. ISO 2631-1978 (E) reduced comfort boundaries for the lateral and vertical directions.

5.0 CURVING PERFORMANCE RESULTS

Modifying a car's suspension to improve its ride quality can also degrade its performance in other regimes. The safety of the modified Ultradome car during curve negotiation was of primary concern in this study. As a result, the NUCARS model was used to predict the performance of the base line and modified Ultradome car models in a 12-degree curve having a bunched spiral. A bunched spiral is a spiral that has a severe rate of change of superelevation and curvature. It is considered to be a "worst-case" condition for curve entry and exit.

Rail car curving safety performance is often evaluated with a criteria called the wheel lateral to vertical (L/V) force ratio. The sum of the ratios for both wheels on an axle, the sum axle L/V, is also used. For freight cars in interchange service, the AAR recommends limits of 1.0 and 1.4, respectively for these criteria. Neither the base line nor modified Ultradome car models predicted ratios in excess of the AAR criteria.

6.0 CONCLUSIONS

1. Staggered low joints in the Alaska Railroad tracks induce lateral instability in the trucks of the Ultradome cars.

2. The frequency of the vibration resulting from the lateral instability at 50 mph (1.7 Hz) coincides with the natural frequency of the car's yaw suspension.

3. A model was developed with the NUCARS program that is capable of accurately predicting the lateral ride quality of the Ultradome car.

4. The Ultradome car model predicted that reducing the friction in the pin bearings of the swing hangers will lower the natural frequency of the car's yaw suspension. The natural frequency drops from 1.7 Hz to 1.2 Hz for a reduction in friction from 2400 pounds to 600 pounds per truck.

5. **Lowering the natural frequency of the Ultradome car model's yaw suspension, by reducing friction in the swing hanger pin bearings to 600 pounds/truck, is predicted to reduce the car body lateral vibration amplitude from 0.1 g's to 0.03 g's, a 70 percent reduction.**

6. **Adding a lateral viscous damper to the swing hanger suspension is predicted to improve the ride quality only if friction in the swing hangers is effectively eliminated.** An optimum damping value of 400 pounds/in/sec. lowers the vibration amplitude to approximately 0.02 g's for the "frictionless" suspension.

7. The ride quality analysis revealed that passengers riding the Ultradome car at 50 mph on straight, jointed track would immediately experience discomfort from lateral and vertical vibrations, according to the ISO 2631-1978 (E) reduced comfort boundaries.

8. According to model predictions, the improved swing hanger suspension with 600 pounds of friction would allow passengers to ride for over 2 hours before experiencing reduced comfort from lateral vibrations. The ideal swing hanger suspension with no friction and a 400 lbs/in/sec damper would allow passengers to ride for over 3 hours before experiencing reduced comfort from lateral vibrations.

9. The Ultradome car model predicted that reducing the journal box lateral clearances and removing the roll stabilizer from the trucks offered little or no improvement in lateral ride quality.

10. The Ultradome car model predicted curve negotiation safety criteria below the AAR recommended maximum limits for either the base line or modified car model.

7.0 RECOMMENDATIONS

The following modifications are recommended to improve the ride quality of the Ultradome cars.

1. Friction in the pin bearings connecting the swing hangers to the truck frames should be reduced either by lubrication or redesign of the bearings. This offers the greatest potential improvement in ride quality.

2. If the swing hanger friction can be essentially eliminated, then adding a damper with 400 lbs/in/sec of damping will further improve the ride quality of the Ultradome cars. As little as 600 pounds of friction in the swing hangers in a truck, however, can negate the benefits of a viscous damper.

SCHEDULE H

ULTRADOME FINITE ELEMENT ANALYSIS

This schedule consists of the 3 pages attached hereto.

ZEILER-PENNOCK, INC.

ENGINEERS-ARCHITECTS

INC.

October 1, 1990

Rader Railcar, Inc.
10700 East 40th Avenue
Denver, CO 80239

ATTN: Jack Webber

RE: 8000 Series Railcar Analysis

Dear Jack,

Enclosed are the results of our analysis on the Series 8000 Railcar. The analysis has been made using "Microsafe's" Finite Element Program on a desktop computer. The model of the car's structure consisted of 485 nodes and 887 members. Six load cases were considered, along with five combinations of those load cases. More specifically, the load cases are:

1. <u>Dead Load</u>
   a. 10 psf for ceiling
   b. 549 lbs. for the window
   c. 15 psf for side walls
   d. 30 psf for flooring, seats, etc.
   e. Tank weights:
      1. Air tanks - 600 lbs.
      2. Portable water tanks - 2800 lbs.
      3. Gray water tanks - 1880 lbs.
      4 Black water tanks - 2330 lbs.
      5. Condensers - 2 @ 500 lbs.
2. <u>Live Load</u> - 40 psf on floor
3. <u>Lateral Load</u>
   a. 100 mph wind - Exposure C
   b. 15% of dead load acting laterally to SIMULATE a centrifugal force
4. <u>Draft Load</u> - (per AAR specs) - A 400 KIP load at the center line of the draft.
5. <u>Buffer Load</u> - (per AAR specs) - A 250 KIP load applied 12 inches above the center line of draft.
6. <u>Vertical Buffer Load</u> - (per AAR specs) - A 50 KIP vertical load applied to the buffer beam.

These loads are combined in the following manner to determine the total effect on car members stresses and deflections:

1. Dead + live load
2. Dead + live + lateral load
3. Dead + draft load
4. Dead + buffer load
5. Dead + vertical buffer load

In summary, the results show deflections to be all in the acceptable range. The significant deflections are, roughly:

1. Dead load - 1" downward
2. Dead + live load - 1 3/8" downward
3. Dead + live + lateral load - 1 3/8" downward, 1 1/4" sideways
4. Dead + vertical buffer load - 1 7/8" downward at center, 1 3/8" upward at ends

Stresses in most all members are well within AISC allowable limits, with the following exceptions:

1. The W8X21 buffer beams at each end are 94% over-stressed when subjected to the buffer load specified by the AAR. To resist this load they must be strengthened or replaced with stronger members.
2. The 4X3X1/4 tube diagonal braces at the "B" end of the car are 27% over-stressed under the vertical buffer load. If replaced with 4X4X1/4 tubes, stresses would be under the allowable.
3. The old floor beams at the bow frames are over-stressed as much as 71% when subjected to lateral loads. They should be replaced with 4X4X1/4 tubes at the bow frames and intermediate half bents.
4. Some new floor beams are over-stressed 36% under lateral loads. The C-type shape should be replaced with a closed tube shape of the same dimensions.

I have enclosed calculations showing the derivation of member properties, loads, and member stresses, as well as the voluminous printouts of the computer analysis. To help interpret the printouts, I have included pages from the Microsafe Manual which describe the output format. <u>Please note</u> - all lengths are in inches and loads are in KIPS.

Rader Railcar, Inc.
October 1, 1990
Page 3

If you have any questions concerning the analysis or results, please let me know. Thank you for allowing us to be a part of this most interesting project.

Very truly yours,

ZEILER-PENNOCK, INC.

Jack C. Zeiler, P.E.
President

JCZ/bp

enclosures

SCHEDULE I

MANUFACTURING EXPERT AND TECHNICAL ARBITER

Manufacturing Expert:

Otto Masick
221 Akenside Road
Riverside, Illinois 60546

Technical Arbiter:

STV/Seelye Stevenson Value & Knecht
11 Robinson Street
PO Box 459
Pottstown, Pennsylvania 19464-0459

SCHEDULE J

FORM OF
APPLICATION FOR PAYMENT

BILLING SUMMARY

PERIOD: [Specify applicable two week period]

EXPENSE CATEGORY	AMOUNT
DIRECT MATERIALS	
DIRECT LABOR	
OVERHEAD	________________
TOTAL	________________
PM ON-SITE FINANCE APPROVAL	________________

EXPENSE BY CATEGORY

PERIOD: [Specify applicable two week period]

	Current Period	Cumulative
Direct Materials		
On-Car Material		
Subassembly Material		
Subcontracting		
Purchased Cars by RRC		
Purchased Cars from RRC	____________	____________
Total Direct Materials		
Direct Labor		
Car Plant Labor		
Subassembly Labor	____________	____________
Total Direct Labor		
Overhead		
Manufacturing and Engr Salary		
Administration Salary		
Subassembly Facility Costs		
Subassembly Equipment		
Subassembly Leasehold IMP		
Car Plant Facility Costs		
Car Plant Equipment/Leaseholds		
Construction Insurance	____________	____________
Total Overhead		
Total	____________	____________

DIRECT MATERIALS INVOICE SUMMARY

PERIOD: [Specify applicable two week period]

Expense Category	Vendor	Invoice #	Amount
On-Car Materials	A	1	
	B	2	
	C	3	______
		Total	
Subassembly Material	A	1	
	B	2	
	C	3	______
		Total	
Subcontracting	A	1	
	B	2	
	C	3	______
		Total	
Purchased Cars by RRC			
Purchased Cars from RRC			______
	Total Direct Materials		______

Note: Original invoices and matched receiving reports are attached.

DIRECT LABOR SUMMARY

PERIOD: [Specify applicable two week period]

Expense Category	Current Period Total Hours	Current Period # Employees	Current Period Amount	Cumulative Amount
Car Plant Labor				
Subassembly Labor				
Total				

Note: Detailed labor report from Rader's job costing system including employee's name, hours worked and amount paid is attached.

OVERHEAD EXPENSE DETAIL

PERIOD: [Specify applicable two week period]

Overhead Expense Type	Attached Support	Amount
Manufacturing and Engr Salary	Payroll Register	
Administration Salary	Payroll Register	
Subassembly Facility Costs	Original Invoices/Contract	
Subassembly Equipment	Original Invoices	
Subassembly Leasehold IMP	Original Invoices	
Car Plant Facility Costs	Original Invoices/Contract	
Car Plant Equipment/Leaseholds	Original Invoices/Contract	
Construction Insurance	Original Invoices/Contract	______
Total Overhead		______

SCHEDULE K
CHANGE ORDER FORM

To. Mr Thomas Rader
Rader Railcar, Inc.
10700 E 40th Avenue
Denver, Colorado 80239

Date.____________

Car No. ___________

Reason for Change: [to be provided by Philip Morris]

Description of Work or Specification to be Changed: [to be provided by Philip Morris]

By· ____________________
Philip Morris Point of Contact

Proposed Adjustment·

Contract Price to be increased/decreased by $__________ due to the following [Rader to provide proposed price adjustment and breakdown of material, equipment and services changes]

Production Schedule to be adjusted as follows: [Rader to provide proposed schedule adjustment and breakdown of changed acquisition or performance requirements]

Final Adjustment:

Contract Price: [to be provided by Philip Morris upon review of Rader proposal and supporting documentation]
Production Schedule: [to be provided by Philip Morris upon review of Rader proposal and supporting documentation]

Upon receipt by Rader Railcar of this document signed by Philip Morris above, the scope of Work shall be changed as described above. Pursuant to the terms of the Agreement between Philip Morris Incorporated and Rader Railcar, Inc., effective _______, the Contract Price or Production Schedule, or both, shall be modified as indicated by the Final Adjustments, if any, noted above upon execution of this document by Rader Railcar and Philip Morris in the signature blocks below Rader Railcar agrees that any Final Adjustments made by this change order shall be full and complete compensation for the change to the scope of the Work described above and, except as provided in the Final Adjustment to the Production Schedule, Rader Railcar shall not be entitled to any extension of the Production Schedule as a result of such change

WITNESS the following signatures:

Philip Morris Incorporated

By ______________________________

Title ______________________________

Rader Railcar, Inc.

By ______________________________

Title ______________________________

SCHEDULE L

FORM OF
PAYMENT AFFIDAVIT

CONTRACTOR'S AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS

The undersigned hereby certifies that, except as listed below, he has paid in full or has otherwise satisfied all obligations for all materials and equipment furnished, for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Agreement for which Philip Morris or its property might in any way be held responsible.

Name	Address	Amount Due

EXCEPTIONS: (If none, write "None.")

RADER RAILCARS, INC.

BY:

Subscribed and sworn to before me this __ day of ______, 19__.

____
Notary Public

My Commission Expires:

SCHEDULE M

FORM OF
CONFIDENTIALITY AND PATENT AGREEMENT

Philip Morris Incorporated has engaged Rader Railcar Inc. ("Rader") to supply specially outfitted railcars. In order for you to supply goods or services for the performance of Rader's obligations pursuant to its agreement with Philip Morris, Philip Morris or Rader may have to disclose to you certain information and know-how that we consider to be confidential and, in consideration of our disclosing the same to you, you hereby agree as follows:

1. You agree not to disclose to others, either directly or indirectly, the fact that Philip Morris and Rader have entered into their agreement or that you have been engaged to assist in the performance of the obligations of the agreement.

2. The term "Confidential Information" as used herein includes all information and know-how supplied to you by Philip Morris or Rader (and includes information obtained through observation while in our facilities) except:

   a. information that you can demonstrate by competent proof to have been in your possession prior to disclosure of such information to you by Philip Morris or Rader;

   b. information that has been furnished to you by a third party as a matter of right and which was not received directly or indirectly from Philip Morris or Rader; and

   c. any other information once it becomes part of the public domain by publication or otherwise through no act of yours.

3. The obligations set forth herein with respect to Confidential Information are perpetual and shall survive the expiration, termination or cancellation of this Agreement. While this Agreement is in effect, you will make no use of such Confidential Information nor disclose the same to any third party except as specifically provided herein.

4. You will disclose our Confidential Information only to those of your employees and agents who need it in connection with your work on our behalf and who have agreed in writing to be bound by the terms of this Agreement.

5. Disclosures initially made orally by Philip Morris' or Rader's employees will be confirmed in writing upon your request in order to enable you to identify Confidential Information, but shall be considered confidential if no such request is made.

6. Any information or disclosures made to Philip Morris shall be on a non-confidential basis, and Philip Morris shall be free to use such information and disclosures without any liability except that which may arise under valid patent rights.

7. All drawings, designs, blueprints, photographs, sketches, software (including but not limited to Philip Morris' CAD menus, cell symbologies and user commands) and other materials prepared by or for you or furnished to you in the course of your work on our behalf shall belong to Philip Morris and shall not be used for, or revealed, divulged or made known to, any person, firm or corporation without the prior written consent of Philip Morris. Upon our request, you will return to Philip Morris all such materials, together with any reproductions of such materials which you may have made provided that you may retain one copy of such materials for record purposes. You hereby assign to Philip Morris, and you agree to require your employees and subcontractors to assign to Philip Morris, all rights, title and interest, including copyright, in all drawings, designs, blueprints, photographs, sketches, software or other materials prepared by you, your employees or subcontractors in the course of your work on our behalf.

8. During the course of your engagement by us, you will take no photographs of our facilities, equipment or specially outfitted railcars without our prior written consent. You will promptly supply us with one copy of each photograph taken.

9. Any new or improved apparatus, process, formula or product discovered or produced by you or your employees or agents in the course of or by reason of your work on our behalf shall belong to Philip Morris, and you shall promptly communicate full information regarding any such discovery or invention to Philip Morris. You and your employees and agents will, upon request and at the expense of Philip Morris, (i) execute through attorneys-in-fact named by Philip Morris any United States or foreign patent application or applications and make such assignments thereof to Philip Morris as may be necessary to obtain a patent or patents for such discovery or invention, and (ii) execute all other documents and take all other actions requested by Philip Morris to further the procuring of such patent or patents and the assignment thereof to Philip Morris.

10. You agree that this Agreement may be enforced directly against you by Philip Morris.

11. The statutes and judicial interpretations of the State of New York shall govern this Agreement.

If you agree to the foregoing terms and conditions, please so indicate by signing this Agreement and returning it to us.

____
for
PHILIP MORRIS INCORPORATED
and
RADER RAILCAR INC.

ACCEPTED AND AGREED
As of ____________________:

By________________________

Name:

Title:

Company Name: